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ABSTRACT

This document, 10th in a series of 11 subvolumes of a handbook providing training for educational research and development personnel in the development of instructional materials, deals with the task of evaluating instructional materials. The document is organized according to the three sequential steps involved in performing the task. Step 1 is to conduct an information tryout of the instructional program and revise the program when necessary. Step 2 is to conduct a developmental tryout of the instructional program and revise the program when necessary. Step 3 is to conduct a field test of the instructional program. More specific substeps list the procedures for performing the steps. Background information covers (a) purposes of evaluation; (b) the cyclical nature of program tryout and revision; (c) four interrelated elements in the tryout and revision process; and (d) the amount of program material to schedule for tryout. (PD)

AIR-20241-9/71-RP

A Technology For Developing Instructional Materials

ED 092512

3 HANDBOOK

A. PLAN STUDY OF CRITERION BEHAVIORS

B. COLLECT AND ANALYZE DATA ABOUT CRITERION BEHAVIORS

C. SEQUENCE AND GROUP CRITERION BEHAVIORS

D. STATE CRITERION AND PREPARATORY OBJECTIVES

E. PLAN SIMULATION BASED ON INSTRUCTIONAL AND LOGISTICAL NEEDS

F. DEVELOP DIAGNOSTIC AND EVALUATIVE TESTS

G. FORMULATE INSTRUCTIONAL STRATEGIES

H. PLAN ACCOMMODATION OF INDIVIDUAL DIFFERENCES

I. DEVELOP INSTRUCTIONAL MATERIALS

J. EVALUATE INSTRUCTIONAL MATERIALS

X. INDEX

AUTHOR:

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VOLUMES IN THIS SERIES

1. USER'S MANUAL
2. ORIENTATION
3. HANDBOOK
   (eleven sub-volumes)
4. WORKBOOK
5. FINAL EXERCISES

FOREWORD

This is one of a series of eleven HANDBOOK sub-volumes which has been prepared to provide training for educational R&D personnel in the development of instructional materials.

The USER'S MANUAL, which accompanies the series, describes the role each volume is designed to play and the sequence recommended for its use in the training process. The user is, therefore, urged to read the Instructions in the USER'S MANUAL before using this or any other separate volume.

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U.S.O.E. sponsorship does not in any way imply official endorsement of the views expressed in this volume.

The author is indebted: to Dr. Robert Fitzpatrick for reviewing portions of the series of volumes and for informal discussions concerning several training issues; to Mrs. Zita Glasgow for the first and critical use of this volume; and, not least, to Miss Kathleen Gubala for her tireless preparation of the complex manuscript required by this HANDBOOK.

George L. Gropper
March 1973

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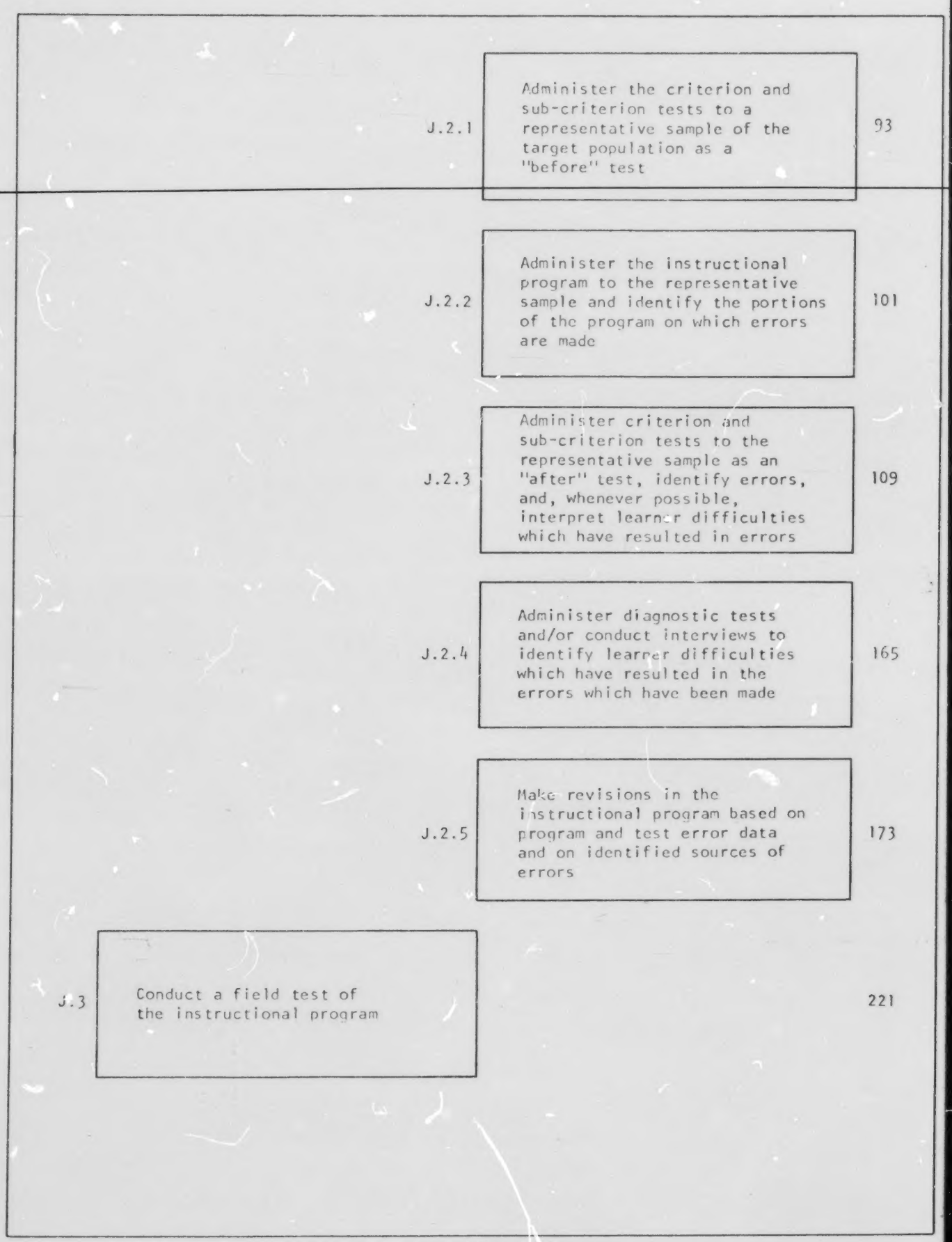
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J. IDENTIFICATION MATRIX	TWO MAJOR PURPOSES IN USING EVALUATION PROCEDURES	
PURPOSES	Assessing the ADEQUACY OF THE INSTRUCTIONAL PROGRAM	Assessing the LEVEL OF STUDENT PROFICIENCY *
CRITERIA	-*An assessment performed only on a limited number of occasions:* ••*During the preparation of the instructional program* ••*Immediately after the program has been completed*	-*An assessment performed on a routine basis every time the instructional program is given*
	-*Assessment is discontinued when student performance based on the program reaches a pre-determined standard*	
	-*Assessment is used to identify weaknesses (allowing those portions of the program which result in errors to be revised)*	-*Assessment is used to identify levels of student proficiency as a basis for decisions:* ••*To allow students to go on to new portions of a program* *OR* ••*To require them to take remedial instructional sequences*
	-*Assessment is based on:* ••*Student performance on the instructional program* ••*Student performance on criterion and sub-criterion tests* ••*Student performance on diagnostic tests* ••*Student responses to diagnostic probes during interviews (during program development)*	-*Assessment is based on:* ••*Student performance on criterion and sub-criterion tests*

*Only evaluation for purposes of "assessing the adequacy of instructional programs" is treated in this volume devoted to TASK "J."

J.

IDENTIFICATION MATRIX

THREE SOURCES OF INFORMATION USED AS A BASIS FOR IDENTIFYING PROGRAM WEAKNESSES AND FOR REVISING THE PROGRAM

SOURCES OF INFORMATION	Student performance on PROGRAM PROBLEMS	Student responses to INTERVIEW PROBES about performance on the program	Student performance on TESTS
CRITERIA	*-Student performance on program problems or tasks is used to identify errors occurring on specific:* *••Program problems* *••Program procedures or tasks* *-To the extent that a problem or task is restricted to one particular component skill, performance on that problem can be diagnostic of a failure to acquire that skill*	*-When a problem solution is dependent on more than one skill, (and an error is therefore not diagnostic of a particular learning failure), the use of interview probes can lead to the identification of:* *••The nature of the error made* *••The possible source of the error*	*-Student performance on tests (whether criterion, sub-criterion, or diagnostic) is used to identify the adequacy of instructional responses to teach:* *••Criterion behaviors* *••Sub-criterion behaviors*
TO BE COVERED IN:	Sub-STEP J.1.1	Sub-STEP J.1.1	Sub-STEP J.1.2

J. IDENTIFICATION MATRIX	WHAT IS PERFORMED IN THE THREE "STEPS" OF TASK "J"

STEPS	J.1 INFORMAL TRYOUT	J.2 DEVELOPMENTAL TRYOUT*	J.3 FIELD TESTING**
CRITERIA	-*The informal tryout of the program with a small sample of students from the target population* -*The revision of the program based on student performance on program problems and tasks*	-*The administration of the program to a representative sample of the target population:* ••*The identification of program problems which result in a relatively high percentage of errors* -*The administration of tests to determine the level of proficiency achieved by students for the criterion and sub-criterion behaviors* -*The revision of the program based on sequences identified as not having produced an adequate proficiency level*	-*The administration of the program to a large sample of the target population as a means of:* ••*Providing specifications of the program's capability of producing a pre-determined level of proficiency*
TO BE COVERED IN: ON PAGE:	STEP J.1 9	STEP J.2 89	STEP J.3 221

*often referred to as "formative evaluation"

**often referred to as "summative evaluation"

J. MATRIX

THE CYCLICAL NATURE OF THE TRYOUT AND REVISION PROCESS

STEPS	J.1 INFORMAL TRYOUT	J.2 DEVELOPMENTAL TRYOUT	* J.3 FIELD TESTING
CRITERIA	-*Informal developmental tryout is performed cyclically:* ••*One or two students take the program, and program problems on which they make errors are revised* ••*An additional one or two students take the revised program; the errors they make on the program become the basis for a further revision* -*Additional informal tryout cycles may be used depending on time/money considerations and on how well the program is working*	-*A tryout of the program with a representative sample of the target population is performed cyclically:* ••*Approximately 25-50 students take the program and associated tests; revisions in the program are made based on program errors and test scores* ••*An additional sample takes the revised program; program errors and test errors are noted; if the predetermined standards are still not met, an additional revision is made, and the revised version is again tried out* -*The tryout and revision cycle ends only when a predetermined standard is met*	-*The final evaluation of the program is not used as a basis for revision* -*The final evaluation with a large sample of the target population (a sample of approximately 200-500) is conducted to provide specifications for the program (if it is to be given wide distribution)* -*Only test results (not program problem results) are likely to be reported*

J.

IDENTIFICATION MATRIX

	FOUR INTERRELATED ELEMENTS IN THE TRYOUT AND REVISION PROCESS			
ELEMENTS	1. STUDENT PERFORMANCE	2. DIAGNOSIS OF LEARNING AND PERFORMANCE FAILURE	3. DIAGNOSIS OF PROGRAM WEAKNESS	4. PROGRAM REVISION
CRITERIA	-*Students' performance provides a basis for diagnosing what students have failed to learn* -*Results used to make diagnoses include:* ··*Errors on program problems or tasks* ··*Errors on tests*	-*Student failures provide a basis for diagnosing weaknesses in the instructional program* -*Learning failures indicative of program weaknesses include failure to acquire:* ··*Discriminations* ··*Generalizations* ··*Associations* ··*Chains* -*Performance failures indicative of program weaknesses include:* ··*Recall/transfer failure* ··*Immediate/delayed basis*	-*Identified program weaknesses provide a basis for revising the program* -*Types of program weaknesses likely to be revealed:* ··*"Amount" of criterion behavior selected to be practiced at the same time is too large* ··*The degree of assistance provided is too low* ··*An insufficient amount of practice has been provided* ··*"Progressions" used have been inadequately implemented* ··*Faulty "behavior control"* ··*Faulty sequencing*	-*Based on identified program weaknesses, the following types of changes are made:* ··*"Amount" of criterion behavior practiced at the same time is reduced* ··*Assistance is strengthened* ··*Additional practice is provided* ··*"Progressions" are improved* ··*Procedures for "behavior control" are improved* ··*Sequence is altered*

J.

DECISION MATRIX

HOW MUCH PROGRAM MATERIAL TO SCHEDULE FOR TRYOUT*			
CONDITIONS	MORE THAN ONE criterion behavior covered in an instructional hour	ONE criterion behavior covered in an instructional hour	It requires TWO OR MORE INSTRUCTIONAL HOURS to cover a criterion behavior
ACTION TO TAKE =	*-Schedule the tryout of all the instructional material it requires to administer (approximately one hour)*		*-Schedule (in one sitting) the tryout of all the instructional material associated with sub-criterion behaviors covered in:* *••One instructional hour* *OR* *••Two or three instructional hours (at a maximum)* *-Schedule as many separate tryout periods as required to cover the criterion behavior*

*The subsequent discussion is concerned with the tryout of instructional materials covering a single criterion behavior and its associated sub-criterion behaviors.

STEP J.1

J.1 Conduct an informal tryout of the instructional program and revise the program when necessary.*

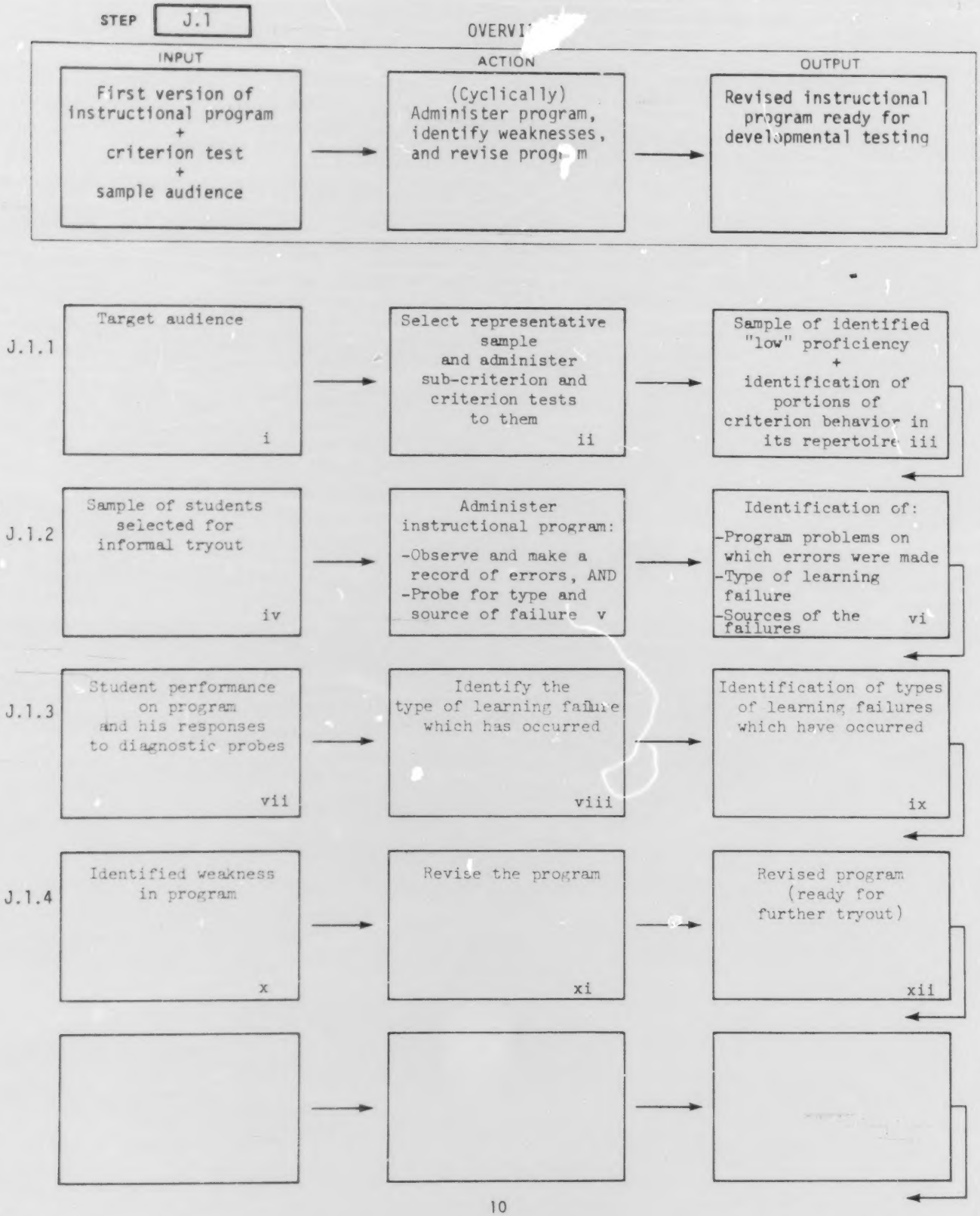
J.1.1 Administer criterion test (and sub-criterion test) as a "before" test to a small sample of the target population.

J.1.2 Administer the program to one student at a time, and, when errors are committed, probe for the source of the problem.

J.1.3 Interpret the nature of the learning failure.

J.1.4 Make revisions in the instructional program based on identified program weaknesses.

*The cycle of Sub-STEPS J.1.1, J.1.2, J.1.3, and J.1.4 should be repeated as many times as is feasible within schedule and budgetary constraints. Reduced frequency of student errors indicates that there is no need for further recycling of informal tryout and revision.


STEP J.1
OVERVI
INPUT
ACTION
OUTPUT
First version of instructional program + criterion test + sample audience
(Cyclically) Administer program, identify weaknesses, and revise prog m
Revised instructional program ready for developmental testing
J.1.1
Target audience
i
Select representative sample and administer sub-criterion and criterion tests to them
ii
Sample of identified "low" proficiency + identification of portions of criterion behavior in its repertoire iii
J.1.2
Sample of students selected for informal tryout
iv
Administer instructional program:
-Observe and make a record of errors, AND
-Probe for type and source of failure v
Identification of:
-Program problems on which errors were made
-Type of learning failure
-Sources of the failures vi
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Revise the program
xi
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STEP J.1

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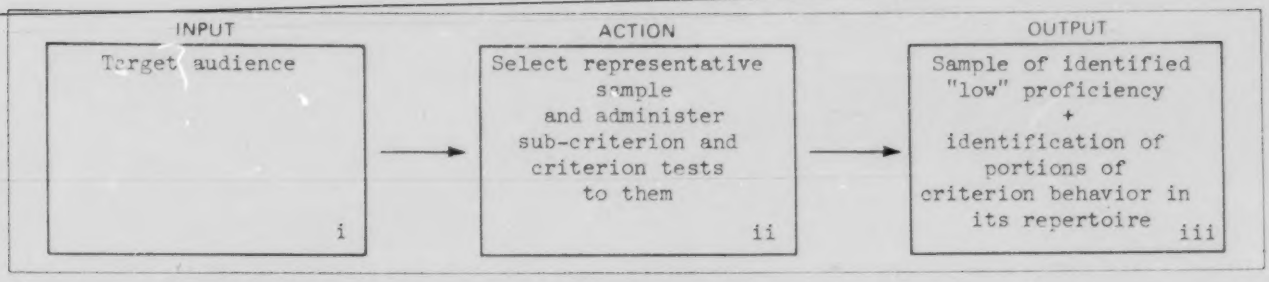
PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*--A small sample of from two to five students will be identified. They will be representative of the target audience but will be at the lower end of the proficiency distribution with respect to the behavior to be taught.* *--Those portions of the criterion behavior already in their repetoire will be identified.*
WHAT YOU WILL WORK FROM	(1) The target audience to be taught. (2) Sub-Criterion and Criterion tests for the material to be taught.
WHAT YOU WILL DO	(1) Select a sample of students from the target audience. (2) Administer the tests to them as a pre-test. (3) Identify low scorers. (4) Select a sample of from two to five of the low scorers.
FORMS YOU WILL USE	None

DESCRIPTION OF Sub-STEP	J.1.1



Job Aid Contents

CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
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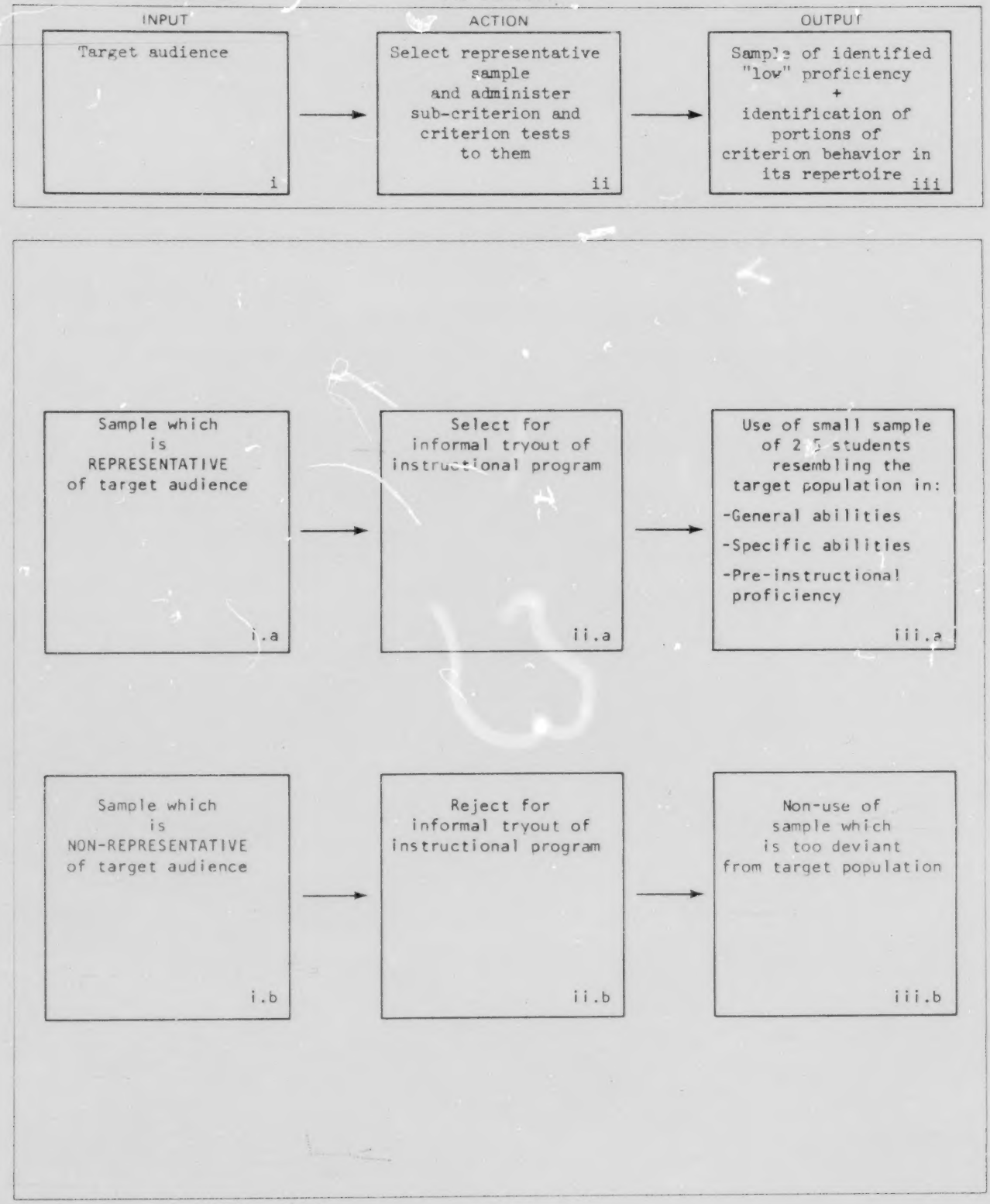
Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
Identification of audience characteristics	A.1.2	Sub-criterion and criterion tests: FORM F.2(1) (carried forward from)	I.2	
Identification of audience characteristics (based on tests)	F.4.2			

Sub-STEP J.1.1

JOB DIAGRAM


INPUT
ACTION
OUTPUT
Target audience
i
Select representative sample and administer sub-criterion and criterion tests to them
ii
Sample of identified "low" proficiency + identification of portions of criterion behavior in its repertoire
iii
Sample which is REPRESENTATIVE of target audience
i.a
Select for informal tryout of instructional program
ii.a
Use of small sample of 25 students resembling the target population in:
-General abilities
-Specific abilities
-Pre-instructional proficiency
iii.a
Sample which is NON-REPRESENTATIVE of target audience
i.b
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ii.b
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iii.b

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J.1.1
IDENTIFICATION
MATRIX

DIFFERENT TYPES OF INFORMATION OBTAINED BY TESTS ADMINISTERED "BEFORE" AND "AFTER" THE INSTRUCTIONAL PROGRAM

TIME OF TEST ADMINISTRATION	Test administered BEFORE instructional program	Test administered AFTER instructional program*
CRITERIA	-*Test results can be used to identify what students can do before they have taken the instructional program:* ••*Whether they can exhibit the total criterion behavior* ••*Whether they can exhibit one or more sub-criterion behaviors which make up the criterion behavior* ••*Whether they can exhibit one or more of the component skills*	-*Test results can be used to identify what students can do after they have taken the instructional program:*
RATIONALE FOR USE	-Permits the developer to differentiate between satisfactory performance on program problems and tasks which is due: ••To students' entering proficiency; OR ••To the capacity of the program to instruct -If the student can perform before beginning instruction, his performance on the program reveals nothing about the program's adequacy	-Results on "after" test, when compared with those on "before" test, can be used to identify how well the program builds proficiency at: ••Criterion behavior ••Sub-criterion behaviors

*Tests administered after informal tryout produce equivocal results. This is so because of the interview procedures used during the program tryout and the effects that questions may have on what is learned. For this reason, it is probably better not to administer the tests after instruction (or if they are used, to interpret their results with caution). "After" tests are used during the developmental tryouts (See STEP J.2).

J.1.1
IDENTIFICATION
MATRIX

	PROPERTIES OF AN ADEQUATELY SELECTED SAMPLE OF TARGET AUDIENCE FOR ADMINISTRATION OF PROGRAM (PRIOR TO REVISION)		
PROPERTIES OF SAMPLE	SIZE	REPRESENTATIVENESS	NON-PROFICIENCY at criterion behavior
CRITERIA	*-Each tryout (before revision) should be based on a sample of:* *••A minimum of <u>two</u> students* *AND* *••A maximum of approximately <u>five</u> students*	*-The sample of students selected for informal tryouts should reflect the target audience for:* *••General ability* *••Relevant, special abilities* *••Estimated levels of entry proficiency (at criterion behavior)*	*-The sample of students selected for informal tryout should:* *••Not consist of students from the upper portion of the distribution of scores identifying pre-instructional proficiency at the criterion behavior*
RATIONALE	-A sample size of from two to five is: ••Of sufficient size to reveal program weaknesses ••Not so large that the interview/ probing procedures used are too time-consuming and costly	-Adequate accommodations of the target audience (i.e., producing a program on which most students can take in relatively error-free fashion) depends on the sample representing: ••The entry behaviors likely to influence performance ••The likely performance of the target audience on the program	-If tryout is performed with students who already are highly proficient, the tryout will not be capable of assessing the adequacy of the program for bringing up to proficiency those students who are <u>not</u> proficient to begin with

JOB PROCEDURES

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J.1.1

STANDARDS MATRIX

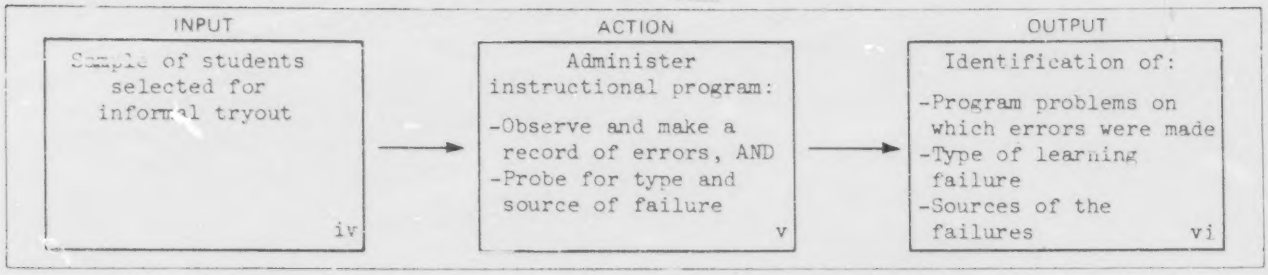
ADEQUACY OF SAMPLE SELECTION
(AND USE OF PRE-INSTRUCTION TEST RESULTS)

PROPERTIES	REPRESENTATIVENESS	SIZE	DEGREE OF PROFICIENCY
CRITERIA	-*Sample selected is representative of (i.e., measures at approximately the mean of distributions) the target population in:* ••*General ability* ••*Specific abilities (relevant to mastery of the criterion behavior)* ••*Pre-instructional proficiency in the criterion behavior*	-*Sample for each tryout and revision cycle ranges from:* ••*Two students* *to* ••*Approximately four or six*	-*Sample has relatively low proficiency in criterion behavior*

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*You will have identified:* *--The program problems on which errors have been made.* *--The type(s) of learning failure identified by these errors.* *--The reasons or sources of those failures.*
WHAT YOU WILL WORK FROM	(1) Sample of two to five students (2) The program to be taken by them
WHAT YOU WILL DO	(1) Administer the program to one student at a time (2) Make a record of errors which occur (3) Probe for the type of error and its cause
FORMS YOU WILL USE	FORM J.2(1) (Optional) for recording errors on the program.

DESCRIPTION OF Sub-STEP	J.1.2



Job Aid Contents

CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
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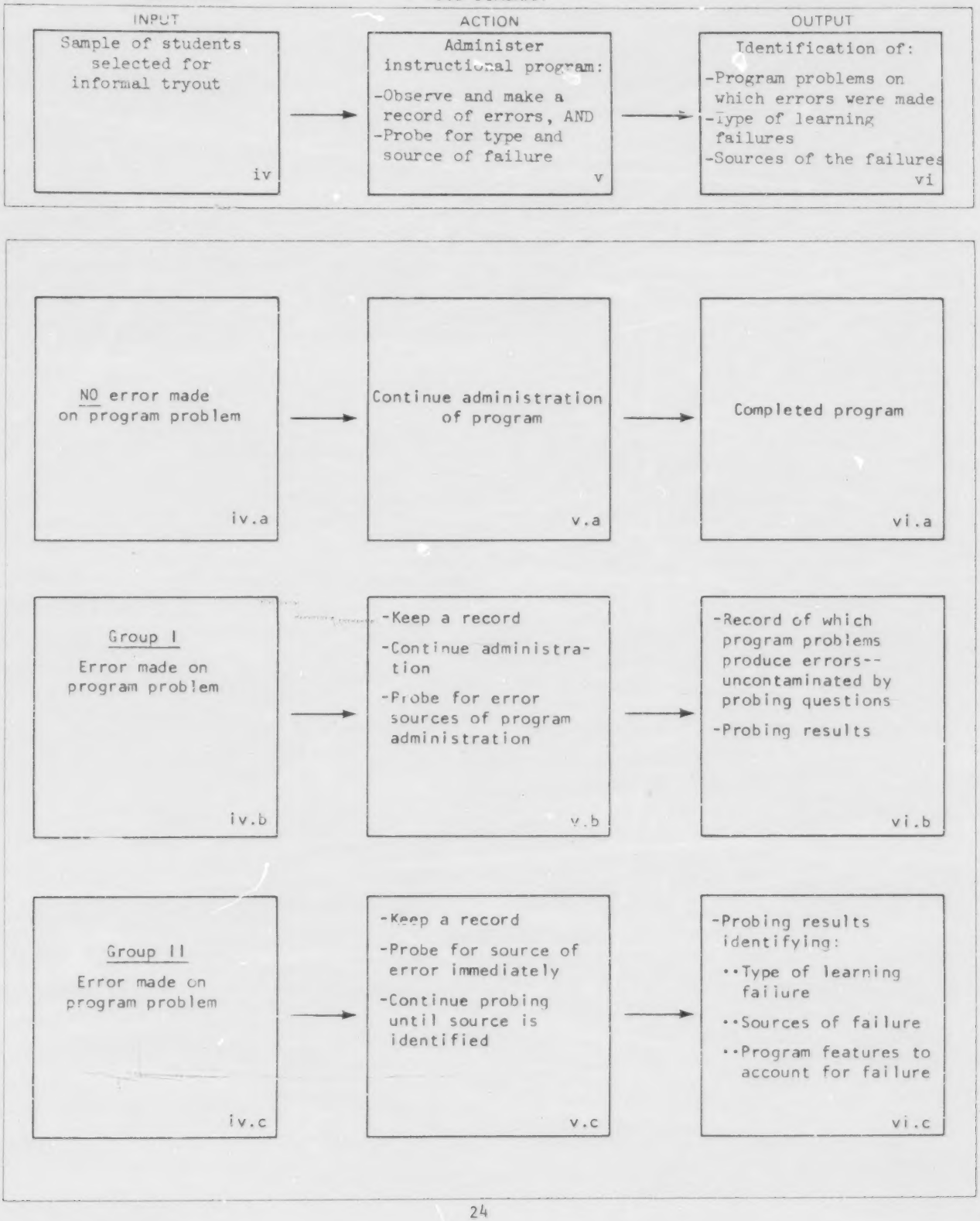
Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
Selection of sample	J.1.1			FORM J.2(1) - Optional
Instructional program	I.2			

Sub-STEP J.1.2

JOB DIAGRAM



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J.1.2

IDENTIFICATION MATRIX

MEDIA CALLING FOR DIFFERENT TRYOUT APPROACHES

TYPES OF MEDIA	Media it is likely to be economically or logistically FEASIBLE to use during informal tryout	Media it is likely to be economically or logistically UNFEASIBLE to use during informal tryout
CRITERIA	*-PRINT media* *··Programs requiring paper-and-pencil responding* *-ENVIRONMENTAL media* *··Objects or equipment already available and for which the risk or cost of damage is slight* *··Already built simulators* *-DEVICE media* *··Those media which prove not costly but only because the extent of their use is <u>low</u> for the instructional program at hand:* */Slides* */Audio tape*	*-ENVIRONMENTAL media* *··Objects or equipment not yet on hand and either costly to acquire or involving high damage risks* *··People to whom or for whom there is a risk factor* *-DEVICE media* *··Those media for which production costs are high:* */Film, animation* */TV* *··Those media whose use will be costly because of the <u>extensive</u> use required by the instructiond program at hand:* */Slides* */Audio tape*

J.1.2
DECISION
MATRIX

DETERMINING HOW TO CONDUCT INFORMAL TRYOUT FOR PROGRAMS INVOLVING DIFFERENT TYPES OF MEDIA

CONDITIONS	Economically and logistically FEASIBLE to use medium required by the instructional program	Economically and logistically UNFEASIBLE to use medium required by the instructional program
ACTION TO TAKE	-*Use the actual media which are called for by the instructional program in the informal tryout*	-*Conduct informal tryouts with storyboard versions of instructional program:* ••*Paper-and-pencil scripts replace dialogue (to appear later on film, TV, or tape)* ••*Drawings or live demonstrations to replace visual events* ••*Mock-ups to replace actual objects* ••*Actors to replace the people who are usually found in the criterion situation* -*Conduct developmental tryouts (See STEP J.2) with actual media*

*

-FORM J.2(1) was designed to serve in summarizing errors on criterion tests (See STEP J.2).

-It is also available, on an optional basis, to serve in summarizing errors which students make on the program during its informal tryout or during its developmental tryout.

HOW TO USE THE FORM

(See opposite page for an example of a filled out FORM)

-A column is used to record tallies for the number of students making errors on each numbered problem or task.

-Each row (labeled a-e) may be used to record the following types of information:

  ··For multiple choice type problems, which incorrect options were chosen.

  ··For problems where more than one response is required, which of the responses is incorrect

-Two rows (with black border) are available for summarizing the total number of people making errors on a program problem and that number expressed as a percentage of the total number of people taking the program.

-The bottom section of the FORM can be used to characterize the nature of the performance required on the problem; i.e., RECALL, because it is a problem that repeats an INPUT or OUTPUT, or TRANSFER, because the problem involves new INPUTS or ACTIONS..

-Sub-criterion problems or criterion problems can be identified by putting one or more asterisks next to the number corresponding to them.

Form J 2(1)

LESSON [ ] (SUB-) CRITERION BEHAVIOR [ ]

SUMMARY OF ERRORS ON CRITERION TEST

ITEM #'S / Options Endorsed	1	2	3	4	5	6	7	8	* 9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
a	//		/						/																
b			/		//																				
c	/						///																		
d	//																								
e																									
Total Number of People Making Errors	5	0	2	0	2	0	3	0	1																
% of Group Making Errors	100	0	40	0	40	0	60	0	20																
Performance Requirements	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
INPUT recall	X			X	X		X																		
INPUT transfer		X	X			X		X	X																
ACTION recall	X	X	X	X			X																		
ACTION transfer					X	X		X	X																

EXAMPLE

*Sub-criterion problem

J.1.2
IDENTIFICATION
MATRIX

TWO SOURCES OF INFORMATION ABOUT PROGRAM ADEQUACY WHICH ARE USED IN INFORMAL TRYOUTS

SOURCES OF INFORMATION	OBSERVATION	INTERVIEW PROBES
CRITERIA	-*As an individual student works on <u>each</u> program problem or task (presented by print, environmental, or device media), the developer observes student performance in order:* ••*To determine whether the student has made an error on that problem;* *AND* ••*To summarize the error results for the whole succession of program problems leading up to the criterion problem(s)*	-*When it is determined from observation that a student has made an error on a particular problem, he is asked probing questions in order:* ••*To identify the source of or the reason for student failure to get a correct answer*

J.1.2
IDENTIFICATION
MATRIX

INFORMATION SOUGHT	TYPES OF INFORMATION YOU WISH TO OBTAIN FROM "OBSERVATION"		
	On WHICH problems are errors being made?	WHAT TYPE of errors are being made?	HOW MANY people are making HOW MANY errors?
CRITERIA	-*On which (numbered) problems are errors made?* -*On multiple choice problems, which incorrect options are endorsed?** -*On a problem with more than one part to it, on which parts are errors made?* -*Is there a succession of problems on all of which errors are made?* -*Where in a succession of problems is an isolated error made?*	-*Are errors made on:* ••*Criterion problems* ••*Sub-criterion problems* *OR* ••*"Progression" problems* -*Are errors being made on problems that involve:* ••*RECALL* *AND/OR* ••*TRANSFER* -*Are errors being made on problems that involve only one component skill (and whose results are therefore diagnostic of a specific problem)?* -*Is an error one of omission (i.e., no answer given) or of commission (i.e., wrong answer given)?*	-*How many people (what percentage of all those doing a problem) make errors on a problem?* -*On multiple choice problems, how many people endorse which wrong options?* -*On multiple part problems, how many people make errors on particular parts?* -*On how many problems in a series leading up to a criterion or sub-criterion are there errors?*

*Whenever a particular option is associated with a particular type of error (e.g., association or discrimination), these results can be diagnostic.

J.1.2

IDENTIFICATION **MATRIX**

	TYPES OF INFORMATION YOU WISH TO OBTAIN FROM "PROBES"		
INFORMATION SOUGHT	WHICH COMPONENT SKILL does the failure induce?	WHICH PROPERTIES of INPUTS, ACTIONS, OUTPUTS account for the failure?	DOES PROBLEM FORMAT account for the failure?
CRITERIA	*-Which component skills does the failure involve:* *··Discriminations* *··Generalizations* *··Associations* *OR* *··Chains* *-Does the failure consist of:* *··The skill being incorrectly learned* *OR* *··The skill not having been learned at all*	*-Which properties of INPUTS, ACTIONS, or OUTPUTS:* *··Do students overlook or not pay attention to* *OR* *··Do students confuse* *-Are there properties of the examples of INPUTS, ACTIONS, or OUTPUTS which are used which result in:* *··Student confusion*	*-Is the error due to:* *··The absence of inadequate or confusing instructions about the problem task* *··A vocabulary or readability level inappropriate for the target audience* *··The absence of or presence of inadequate or confusing techniques used to direct attention or observation*

THE "PROBING" PROCESS

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When probes are needed	34
Priorities in the types of probes used	35
Some general probes to use to identify problems	36
Follow-up probes to use in response to student answers to initial probes	37, 38
General vs. specific types of probes	39
Responses to general probes which do not unambiguously identify the type of learning failure	40
Specific probes which can be used to identify the type of learning failure	41
Why probes are not needed concerning "chaining" failures	42
Timing of probes	43

J.1.2
DECISION MATRIX

DETERMINING WHEN PROBES ARE NEEDED

CONDITIONS	An error is made on a problem or task AND The problem or task involves MORE THAN ONE component skill	An error is made on a problem or task AND The problem or task involves ONLY ONE component skill
ACTION TO TAKE	-*Probe in order to find out which component skill may not have been learned** *The same wrong response may be indicative of a failure to learn a discrimination, generalization, or association	-*Do not probe; failure on the problem identifies which component skill:* ••*Has not been learned* *OR* ••*Has been learned incorrectly*
EXAMPLE	Example of a non-diagnostic problem *"Which is correct?"* ___*The man walk to work.* ___*The man walks to work.* An error could be due either to a failure to discriminate between singulars or plurals; or to a failure to associate the proper form of the verb with singular and plural forms.	Example of a diagnostic problem *"Both sentences below use a subject which is singular. Which has the correct verb?"* ___*The man walk to work.* ___*The man walks to work.* An error is likely to be due to a failure to associate the proper form of the verb with a singular subject. (This assumes that the student has already learned what a singular subject is.)

J.1.2

DECISION MATRIX

DETERMINING PRIORITIES IN THE ORDER IN WHICH DIFFERENT TYPES OF PROBING QUESTIONS SHOULD BE ASKED

PRIORITIES	FIRST	If first answers provide indeterminate results SECOND	If second answers still provide indeterminate results THIRD
ACTION TO TAKE	-*Ask open-ended questions which do not identify or suggest answers student might give* -*Do not call attention either to the INPUTS or to the ACTIONS for him to focus on* -*Do not call attention to specific properties of INPUTS or of ACTIONS to focus on* -*Do not direct attention to any features of problem format*	-*Ask directed questions which identify what the student should consider when trying to assess what went wrong* -*Call attention generally either to the INPUTS or to the ACTIONS for him to focus on* *OR* -*Call attention generally to the problem format, BUT* -*Do not call attention to specific properties of INPUTS or of ACTIONS to focus on* -*Do not call attention to specific properties of the problem format*	-*Ask directed questions* -*Call attention to INPUTS or to ACTIONS* -*Call attention to specific properties for student to focus on*
EXAMPLES	-"Why did you take this ACTION?" e.g., *"Why did you classify the leaf this way?"* -"Is there anything about the way the problem is presented which led you to give your answer?"	-"What is there about this INPUT that made you take this ACTION?" e.g., *"What property or attribute of this leaf made you classify it this way?* -"Did you have trouble with: ••*The vocabulary* ••*The instructions* ••*The meaning of sentences* ••*The use of the diagrams* ••*Etc.*	-"Which of these _____ of the properties made you take this ACTION?" INPUTS e.g., *"Which of these leaf properties: size, shape, or color made you make this particular classification?"* -"Did you have trouble with: ••*This word* ••*This diagram* ••*This illustration* ••*The significance of this arrow* ••*Etc.*

J.1.2

DECISION MATRIX

DETERMINING WHAT GENERAL PROBES TO USE (ON PROGRAM PROBLEMS WHICH ARE NON-DIAGNOSTIC)

CONDITIONS	-NO answer is given -NO procedure or ACTION is taken on program problem	-A WRONG answer is given -A WRONG procedure or ACTION is taken on program problem
ACTION TO TAKE (by priorities)	*#1: OPEN-ENDED PROBE* *··What's giving you trouble on this problem?* *··What did you leave out the answer (fail to do something)?*	*#1: OPEN-ENDED PROBE* *··What made you give the answer you did?* *··What is there about the problem that led you to give that answer?*
	#2: LESS OPEN-ENDED PROBE *··Are there any answers you thought of but ruled out? (If so, why?)* *··Are there any changes that could be made in the problem that would have enabled you to solve it?*	*#2: LESS OPEN-ENDED PROBE* *··Are there any other answers you thought of but ruled out? (If so, why?)* *··What changes in the problem would lead you to give another answer?*
	#3: MORE DIRECT PROBE *··If I call your attention to this _____ (property) of the _____ (INPUT) or _____ (ACTION), can you give the answer now?* *··Here are some possible answers; which is the right one?*	*#3: MORE DIRECT PROBE* *··If I call your attention to this _____ (property) of the _____ (INPUT) or _____ (ACTION), would you still give the same answer?* *··Which of these properties, _____, _____, or _____, did you consider relevant (irrelevant)?*

J.1.2

DECISION MATRIX

DETERMINING WHAT KINDS OF FOLLOW-UP PROBES TO USE IN RESPONSE TO STUDENT ANSWERS TO INITIAL PROBES (ERROR ON PROGRAM: NO ANSWER)

CONDITIONS	-Type of error on program: ··No answer + -Response to earlier, more open-ended probe: ··"I DON'T KNOW"	-Type of error on program: ··No answer + -Response to initial probes: ··Cites possible answers or properties of INPUTS or ACTIONS about which he is UNCERTAIN	-Type of error on program: ··No answer + -Response to initial probes: ··Cites irrelevant or incorrect properties of INPUTS or ACTIONS ··Cites incorrect answers
ACTION TO TAKE	*-Use less open-ended probes* *-Continue using increasingly more direct probes until student identifies the source of the difficulty:* *·Features of the problem content* *OR* *··Features of the problem format*	*-Probe for which answer he thinks correct (and why)* *-Probe for reason for his uncertainty* *-Probe for student's idea of the relationship between properties he identifies and possible answers*	*-Probe for why he cited these properties and how they relate to the answer* *-Probe for why he gave the answers he did* *-Probe for alternative answers he considered and why he rejected them*
EXAMPLES	SEE PAGE 36	-"Which of the answers you mentioned do you think is correct? Why?" -"What is it that makes you uncertain?" -"What else do you feel you need to know in order to decide?"	-"Why did you say _____ ?" (incorrect answer) -"Why did you say _____ ?" (incorrect/irrelevant property) -"Did you consider any other _____ ?" (answers/properties)

J.1.2

DECISION MATRIX

DETERMINING WHAT KINDS OF FOLLOW-UP PROBES TO USE IN RESPONSE TO STUDENT ANSWERS TO INITIAL PROBES (ERROR ON PROGRAM: INCORRECT ANSWER)

CONDITIONS	-Type of error on program: ··Incorrect answer + -Responses to earlier, more open-ended probe: ··"I DON'T KNOW"	-Type of error on program: ··Incorrect answer + -Responses to initial probes: ··Cites irrelevant or incorrect properties
ACTION TO TAKE	*-Use less open-ended probes* *-Continue using increasingly more direct probes until student identifies the source of the difficulty:* *··Features of the problem content* *OR* *··Features of the problem format*	*-Probe for why he cited these properties and how they relate to the answer* *-Probe for why he gave the answers he did* *-Probe for alternative answers he considered and why he rejected them*
EXAMPLES	SEE PAGE 36	*-"Why did you say incorrect answer?"* *-"Why did you say incorrect/irrelevant property?"* *-"Did you consider any other answers/properties?"*

J.1.2

IDENTIFICATION MATRIX

PURPOSE OF TWO TYPES OF PROBES: GENERAL VS. SPECIFIC

TYPES OF PROBES	GENERAL PROBES	SPECIFIC PROBES
CRITERIA	*The ultimate aim of both types of probes is to identify the specific type of learning failure that occurred (i.e., discriminations, generalizations, associations, or chains) and the reasons for the failure.*	
	-The probing process begins with general, open-ended probes in order not to provide the student with clues as to possible responses to the probes	*-Following responses to general probes, if it is still not clear which type of learning failure has occurred and why it has occurred, probes specifically designed to identify the failure are used*
EXAMPLES	SEE PAGES 36-38	SEE PAGES 40-41

J.1.2

IDENTIFICATION MATRIX

SITUATIONS FOLLOWING RESPONSES TO GENERAL PROBES IN WHICH IT IS UNCLEAR WHICH COMPONENT SKILL(S) HAS OR HAS NOT BEEN IDENTIFIED AS THE ONE NOT LEARNED

SITUATIONS FOLLOWING USE OF GENERAL PROBES	Uncertainty whether there has been a failure to learn DISCRIMINATIONS	Uncertainty whether there has been a failure to learn GENERALIZATIONS	Uncertainty whether there has been a failure to learn ASSOCIATIONS
CRITERIA	*Responses to general probes have failed to indicate:* *-Whether a student can or cannot tell the difference between INPUTS belonging to different classes because he does none of the following; he does NOT:* *··Identify (correctly or incorrectly) the class to which the example used in the problem belongs* *··Attribute class properties (correctly or incorrectly) to the example*	*Responses to general probes have failed to indicate:* *-Whether a student can or cannot see the similarity among INPUTS belonging to the same classes because he does none of the following; he does NOT:* *··Identify (correctly or incorrectly) the class to which the example used in the problem belongs* *··Attribute class properties (correctly or incorrectly) to the example*	*Responses to general probes have failed to indicate:* *-Whether a student can or cannot tell which ACTION goes with which INPUT because he does none of the following; he does NOT:* *··Identify all possible ACTIONS that could be taken (depending on which class of INPUTS is involved)* *··Identify all possible INPUTS which would require different actions* *··Mismatch INPUTS and ACTIONS*
EXAMPLES	e.g., *-The student has on a program problem incorrectly labeled a lever as a 2nd class lever* *-In response to probes he does not say why he labeled it that way; he doesn't say, for example, because the effort force is between the resistance force and the fulcrum*		e.g., *-The student doesn't identify properties of the three classes of levers and then indicate that he doesn't know which is called 1st, 2nd, or 3rd class*

J.1.2

DECISION MATRIX

DETERMINING HOW TO PROBE SPECIFICALLY FOR SPECIFIC TYPES OF LEARNING FAILURES WHEN GENERAL PROBES HAVE NOT IDENTIFIED THEM

CONDITIONS	Uncertainty whether there is a DISCRIMINATION failure	Uncertainty whether there is a GENERALIZATION failure	Uncertainty whether there is an ASSOCIATION failure
ACTION TO TAKE	-*Present additional examples from a different INPUT class which is represented in the original program problem and ask:* ••*Are these the same or different?* *OR* ••*Should these be handled or treated the same way or in different ways?* -*If examples vary dimensionally, present pairs of INPUT examples (using the original example as one member) which start far apart and gradually are made more similar* ••*Determine when and where discrimination breaks down*	-*Present additional examples from the same INPUT class which is represented in the original program problem and ask:* ••*Are these the same or different?* *OR* ••*Should these be handled or treated the same way or in different ways?* -*If examples vary dimensionally, present pairs of INPUT examples (using the original example as one member) which start close together and gradually are made more dissimilar* ••*Determine when and where generalization breaks down*	-*If behavior has been taught in two directions: INPUT → ACTION and ACTION → INPUT:* ••*Reverse a test question and determine whether same mismatch occurs* -*Identify for the student all the classes of inputs and all the actions that can be taken and then ask:* ••*Which ACTION goes with which INPUT?* ••*This is how I pair them up. Am I right or wrong?*
EXAMPLES	e.g., "Here's another lever (from same or different class); is this like the one in the problem or different from it?" "What do they have in common?" *OR* "In what way are they different?"		e.g., "Here are examples of all three classes of levers. Which of them belongs to the 1st, to the 2nd, and to the 3rd class?"

J.1.2

IDENTIFICATION MATRIX

DIFFERENCES IN NEED TO PROBE FOR COMPONENT SKILLS	
PROBING NEEDS	There IS a need to probe for failure in: -Discriminations -Generalizations -Associations
CRITERIA	*-A wrong answer for a single Sub-STEP (involving just one association) can be due to one or more of the above types of failure* *-Therefore, probing is designed to find out which of the types of failures occurred*

There is NO need to probe for failure in: -Chaining
-Probing is used to find out the type of failure involved within each of the separate Sub-STEPS in a chain *-When the problem task involves producing a series of Sub-STEPS (i.e., a chain), the performance itself reveals whether:* *··A Sub-STEP is omitted* *··Sub-STEPS are performed in the wrong sequence* *-Probing is therefore unnecessary to identify a "chaining" failure**

*Probing for student reasons for omissions or incorrect sequences can be used.

J.1.2

DECISION MATRIX

DETERMINING WHEN TO PROBE AND HOW TO TIME "PROBING"

GOALS	For obtaining OBSERVATIONAL error data uninfluenced or uncontaminated by probing procedures	For obtaining responses to PROBES
ACTION TO TAKE	*-Administer the entire program to one or two students of the sample* *-Observe occurrences of errors-- but do NOT probe for nature or causes of problem at the time* *-Allow student to complete the program and then go back to program problems or tasks and begin probing*	*-See Way #1 in the left-hand column* + *-Administer the entire program to one or two students in the sample* *-Observe occurrences of errors and* *··Before the student is given feedback* *··Begin probing* *-Use general probes before using specific probes* *-When using specific probes, probe for failures in this order:* *··Re: Discriminations* *··Re: Generalizations* *··Re: Associations*
RATIONALE	-Probing while the student is taking the problem will disallow an uncontaminated assessment of the capacity of the program sequence (as originally developed) to bring students up to proficiency -Probing immediately after an error provides clues to the student which may help him on subsequent problems	-Probing before feedback is given allows determination of whether the student has learned anything (unprompted by the feedback)

JOB PROCEDURES

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J.1.2

ILLUSTRATION SUMMARIZING PROCEDURES INVOLVED IN ADMINISTERING PROGRAM, RECORDING ERRORS, AND PROBING FOR SOURCE OF LEARNING FAILURE

#1

LOOK FOR ERRORS

a. Administer instructional program individually to <u>each</u> student in the sample

b. Observe occurrence of error(s) on program problem or task

c. Make a record of occurrence and of the type of error*

d. (OPTIONAL) Use FORM J.2(1) to summarize errors on all program problems

#2

PROBE FOR REASONS FOR ERRORS

a. Use <u>general</u> probes for identifying source of errors:

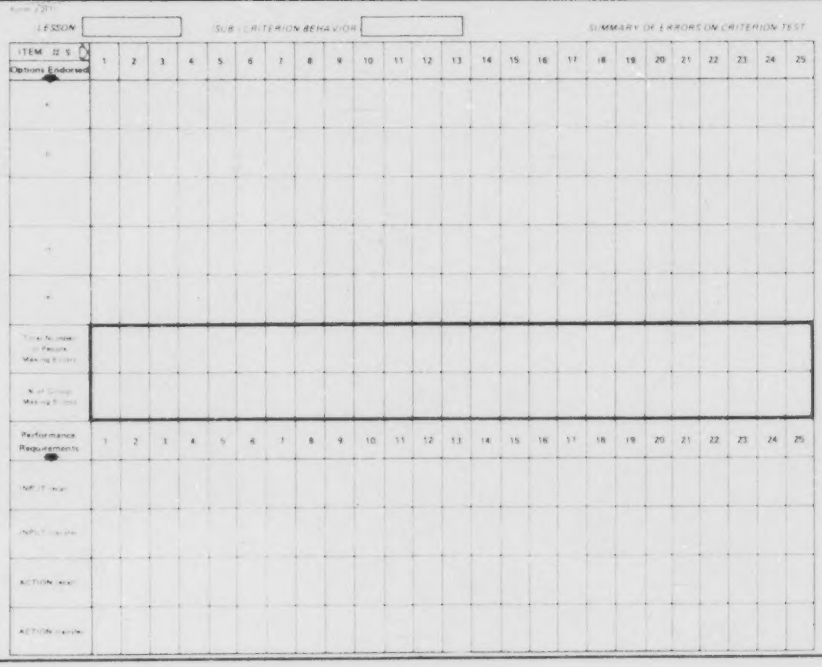
- ··Start with open-ended probes;
- ··Continue with less open-ended probes;
- ··Use direct probes

b. Use probes to follow up student responses to initial probes

c. Use specific probes to identify specific problems

**On printed programs a record can be kept on a copy of the program itself.*

FORM J.2(1)


LESSON
SUB-CRITERION BEHAVIOR
SUMMARY OF ERRORS ON CRITERION TEST
ITEM #'S
Options Endorsed
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Performance Requirements
INPUT
INPUT
ACTION
ACTION

J.1.2

STANDARDS MATRIX

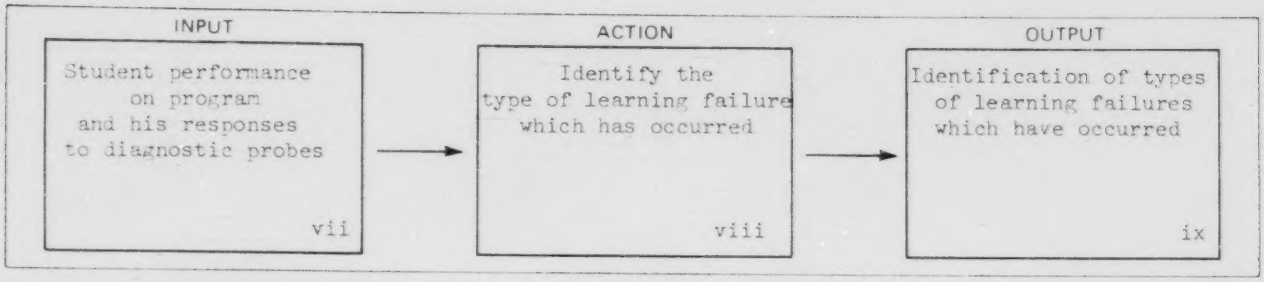
ASSESSING THE ADEQUACY OF THE OBSERVATIONAL AND PROBING PROCESS

PROPERTIES	AVAILABILITY OF A RECORD	COMPLETENESS
CRITERIA	-*A record identifying:* ••*All program problems or tasks on which errors have been made* ••*The parts of the problem on which errors have been made* *(Where applicable) the incorrect options selected* -*A record of responses to probes:* ••*On a printed program itself, or* ••*On paper for non-printed programs*	-*An attempt to identify:* ••*The nature of the learning failure (which skills not learned)* ••*The sources of the failure (properties of INPUTS or ACTIONS causing problems)* -*An attempt to identify features of the program which can account for the failure:* ••*Content (e.g., examples used)* ••*Format (vocabulary, instructions, diagrams, etc.)*

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*An identification of the nature of the learning failures which have occurred for the two to five students who took the program.*
WHAT YOU WILL WORK FROM	(1) A record of student performance (errors) on the program. (2) Students' responses to diagnostic probes concerning the errors they made.
WHAT YOU WILL DO	Identify the types of learning failures which have occurred and their sources.
FORMS YOU WILL USE	None

DESCRIPTION OF Sub-STEP	J.1.3



Job Aid Contents

CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
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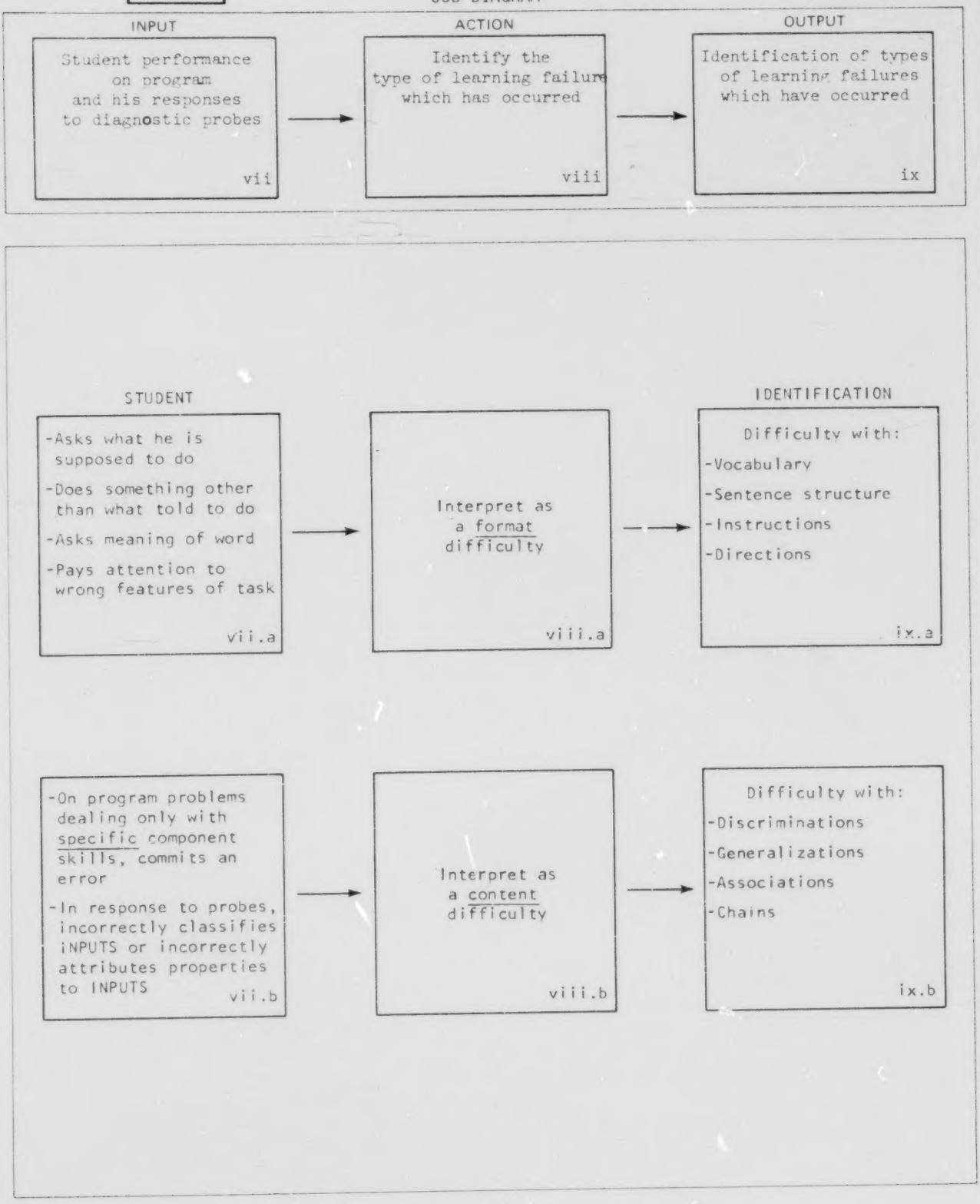
Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
Administration of program and interview results	J.1.2			

Sub-STEP J.1.3

JOB DIAGRAM



BACKGROUND INFORMATION

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Evidence indicating content difficulties re: Generalizations	55
Evidence indicating content difficulties re: Associations	56
Evidence indicating content difficulties re: Chains	57

J.1.3

IDENTIFICATION MATRIX

TYPES OF PROBLEMS	TWO MAJOR TYPES OF DIFFICULTIES THE STUDENT MAY HAVE WITH A PROGRAM PROBLEM	
	CONTENT difficulties	FORMAT difficulties
CRITERIA	-*The student has difficulties making or forming required:* *··Discriminations,* *··Generalizations,* *··Associations,* *OR* *··Chains* -*The student deals inadequately with properties of INPUTS, ACTIONS, or OUTPUTS:* *··Ignores relevant properties* *··Attends to irrelevant properties* *··Confuses properties*	-*The student has difficulties with the format of program problem or task:* *··Fails to understand* *OR* *··Misunderstands* *OR* *··Ignores:* */Vocabulary* */Task instructions* */Cues designed to control attention or observing behavior* */Statement of objectives*

J.1.3

IDENTIFICATION MATRIX

EVIDENCE INDICATING WHAT FORMAT DIFFICULTIES A STUDENT MAY BE HAVING WITH A PROGRAM PROBLEM

SOURCE OF EVIDENCE	OBSERVATION as a source of evidence about format problem difficulties	RESPONSES TO PROBING as a source of evidence about format problem difficulties
CRITERIA	-*A student failure to understand instructions or a misunderstanding of instruction is indicated when the student:* ••*Asks what he is supposed to do* ••*Does a task other than that called for by instructions* ••*Pays attention to features or elements of the problem task other than those problem instructions directed him to attend to* -*A student failure to understand vocabulary is indicated when:* ••*A student asks the meaning of a word*	-*Student indicates in response to probes that he failed to understand or that he misunderstood:* ••*What task he was supposed to perform on problem* ••*The vocabulary used in instructions or in the statement of problem or in the statement of objectives*
EXAMPLES	e.g., -*The student carried a numerical answer out to one decimal place, having been instructed to carry it out to three places* -*"What does 'shaping' mean?"*	e.g., -*"I thought I was supposed to carry the answer out to one decimal place."* -*"I didn't know what 'shaping' means."*

J.1.3
IDENTIFICATION
MATRIX

EVIDENCE SYMPTOMATIC OF CONTENT DIFFICULTIES:
DISCRIMINATIONS*

SOURCE OF EVIDENCE	OBSERVATION as a source of evidence about content difficulties	RESPONSES TO PROBING as a source of evidence about content difficulties
CRITERIA	-*Commits an error on a program problem or task which involves only "discrimination" (e.g., a same/different type problem involving INPUTS from different classes)* -*On a given problem, INPUTS from two or more different classes are presented; and the student takes the same ACTION in response to them both (all)*	*IN RESPONSE TO GENERAL PROBES* -*Attributes membership for the example of an INPUT (which was used in the example) to the wrong class* -*Attributes properties to an example which it does not have (i.e., they are properties of another class)* -*Says he doesn't know which class the example belongs to* *IN RESPONSE TO SPECIFIC PROBES* -*When presented additional INPUT examples (from same or different classes) and asked are they the same or different, fails to distinguish between examples from different classes*

*The more items there are providing comparable evidence, the more dependable the diagnosis is.

EXAMPLES	e.g , -"When selecting a verb, how would you treat these two nouns: (1) women, and (2) women?" X the same way ___ different way -"Here are two nouns; make up two sentences, each one using one of the nouns and the correct form of the verb 'to be': (1) woman, and (2) women." The woman is pretty. The women is all here.	e.g., -Student says, "I said 'women is' because 'women' is singular." -When given additional examples of singular and plural nouns, the student incorrectly says "same" or "different" when singular and plural are compared or when two of the same number are paired.

J.1.3

IDENTIFICATION MATRIX

EVIDENCE SYMPTOMATIC OF CONTENT DIFFICULTIES: GENERALIZATIONS*

SOURCE OF EVIDENCE	OBSERVATION as a source of evidence about content difficulties	RESPONSES TO PROBING as a source of evidence about content difficulties
CRITERIA	-Commits an error on a program problem or task which involves only "generalization" (e.g., a same/different type problem involving INPUTS from the same class) -On a given problem, more than one INPUT from the same class is presented; and the student takes a different ACTION in responce to them	*IN RESPONSE TO GENERAL PROBES* -Attributes membership for the example of an INPUT (which was used in the example) to the wrong class -Attributes properties to an example which it does not have (i.e., they are properties of another class) -Says he doesn't know which class the example belongs to *IN RESPONSE TO SPECIFIC PROBES* -When presented additional INPUT examples (from same or different classes) and asked are they the same or different, fails to distinguish between examples from different classes

*The more items there are providing comparable evidence, the more dependable the diagnosis is.

EXAMPLES	e.g., -"When selecting a verb, how would you treat these two nouns: (1) man, and (2) woman?" X the same way ___ different way -"Here are two nouns; make up two sentences, each one using one of the nouns and the correct form of the verb 'to be': (1) woman, and (2) man." The man is sick. The woman are sick.	e.g., -Student says, "I said 'women is' because 'women' is singular." -When given additional examples of singular and plural nouns, the student incorrectly says "same" or "different" when singular and plural are compared or when two of the same number are paired.

J.1.3
IDENTIFICATION MATRIX

EVIDENCE SYMPTOMATIC OF CONTENT DIFFICULTIES: ASSOCIATIONS*

SOURCE OF EVIDENCE	OBSERVATION as a source of evidence about content difficulties	RESPONSES TO PROBING as a source of evidence about content difficulties
CRITERIA	-*Commits an error on a program problem or task which involves only "association" (e.g., a problem in which all INPUTS and ACTIONS are given and the student is required to match them up)* -*On a given problem, INPUTS from more than one class are presented and the student takes a different ACTION for each (therefore making a correct discrimination) but matches up INPUTS and ACTIONS incorrectly*	*IN RESPONSE TO GENERAL PROBES* -*Says he knows what all the possible ACTIONS are (and can identify them) but adds that he doesn't know which one goes with which class of INPUTS* -*Says he took the ACTION he did because the example in the problem is of the type calling for that ACTION* *IN RESPONSE TO SPECIFIC PROBES* -*When given all the INPUT classes and all the possible ACTIONS, pairs them up incorrectly*
EXAMPLES	e.g., -"*Match up these verbs and nouns:*" B man — A. *is* A men — B. *are* -"*Make up a sentence for each of these nouns and use the correct form of the verb 'to be': (1) the man, and (2) the boys.*" The man are all right. The boys is here today.	e.g., -"*I know some nouns get 'is' and some get 'are,' but I don't know whether it's the singular nouns or the plural nouns which get one or the other.*"

*The more items there are providing comparable evidence, the more dependable the diagnosis is.

J.1.3

IDENTIFICATION MATRIX

EVIDENCE SYMPTOMATIC OF CONTENT DIFFICULTIES: CHAINS

SOURCE OF EVIDENCE	OBSERVATION as a source of evidence about content difficulties	RESPONSES TO PROBING as a source of evidence about content difficulties
CRITERIA	-*The student omitted a Sub-STEP in the chain* -*The student performed all the Sub-STEPS in the chain but in the wrong sequence* -*The student performs a Sub-STEP which is not a part of the chain*	*IN RESPONSE TO GENERAL PROBES* -*Indicates he forgot what do do at a particular point* -*Indicates that he was confused about which Sub-STEP followed at a particular point* *IN RESPONSE TO SPECIFIC PROBES* -*When Sub-STEPS are identified for him, he incorrectly identifies the required sequence*
EXAMPLE	e.g., -*The music student failed to make a "repeat"* -*The music student played the "repeat" but at the wrong place in the music* -*The music student makes a "repeat" which is not called for*	e.g., -*"I don't remember what comes next."* -*"I don't know which one of the variations should be played right now."*

JOB PROCEDURES

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Adequacy of procedures for interpreting learning failures	61

J.1.3

ILLUSTRATION SUMMARIZING PROCEDURES INVOLVED IN INTERPRETING STUDENT DIFFICULTIES OCCURRING ON PROGRAM PROBLEMS OR TASKS

#1

For each program problem on which an error is made,

REVIEW

a. Observational data (obtained from students who were interviewed after completing the whole instructional sequence) for:

- Type of problem and type of error made
- Number of students making errors

b. Probing data obtained from all tryout students

#2

For each program problem on which an error is made,

IDENTIFY

a. The probable type of content difficulty:

- Discriminations,
- Generalizations,
- Associations, OR
- Chains

b. The properties of INPUTS or ACTIONS which are the source of the difficulty

c. The probable type of problem format difficulty:

- Vocabulary
- Instructions
- Statement of objectives
- Other cues

J.1.3

STANDARDS MATRIX

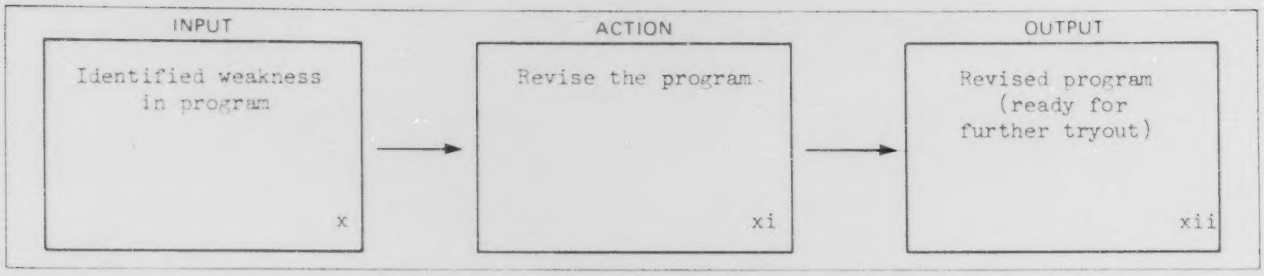
ASSESSING THE ADEQUACY OF PROCEDURES FOR INTERPRETING STUDENT DIFFICULTIES ON PROGRAM PROBLEMS OR TASKS

PROPERTIES	COMPREHENSIVE	DATA-BASED
CRITERIA	*-Interpretation of error(s) on a program problem attends both to:* *••Content difficulties* *••Format difficulties* *-Content difficulties are, in addition, further explored for:* *••Properties of INPUTS and/or ACTIONS which account for the difficulty* *-Content difficulties are explored to determine whether:* *••No learning has occurred* *OR* *••Incorrect learning has occurred*	*-Interpretation is based on data obtained from the entire tryout sample:* *••More weight is given to a diagnosis based on what most of the tryout sample does or says* *-Interpretation is based on all available data about a program problem:* *••Observational data* *••Probing data*

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*A program which has been revised on the basis of tryout results.*
WHAT YOU WILL WORK FROM	(1) The original program (2) Weaknesses in the program which you have identified on the basis of the tryout
WHAT YOU WILL DO	Revise the program
FORMS YOU WILL USE	None

DESCRIPTION OF Sub-STEP	J.1.4



Job Aid Contents

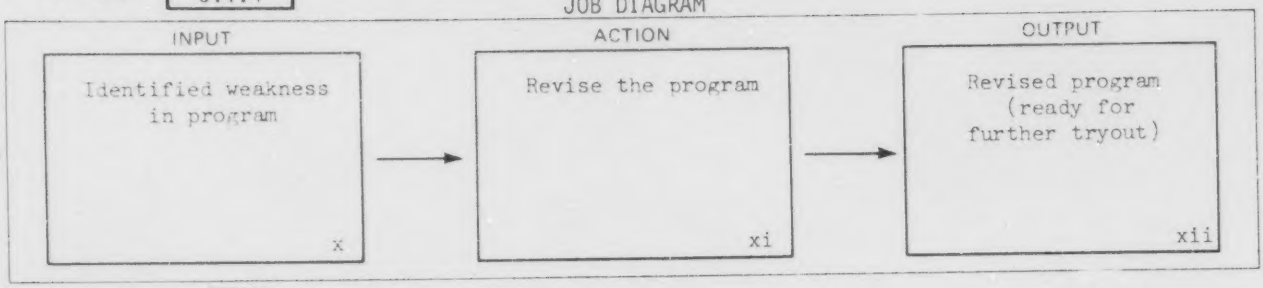
CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
-MATRIX: Types of program weakness . . 67, 69, 70	-MATRIX: Revising program . 63, 71 -MATRIX: Revising for specific difficulties . 76-81 -MATRIX: Priorities to observe when revising program 73	-MATRIX: Adequacy of program revision 87	SUMMARY OF PROCEDURES 86

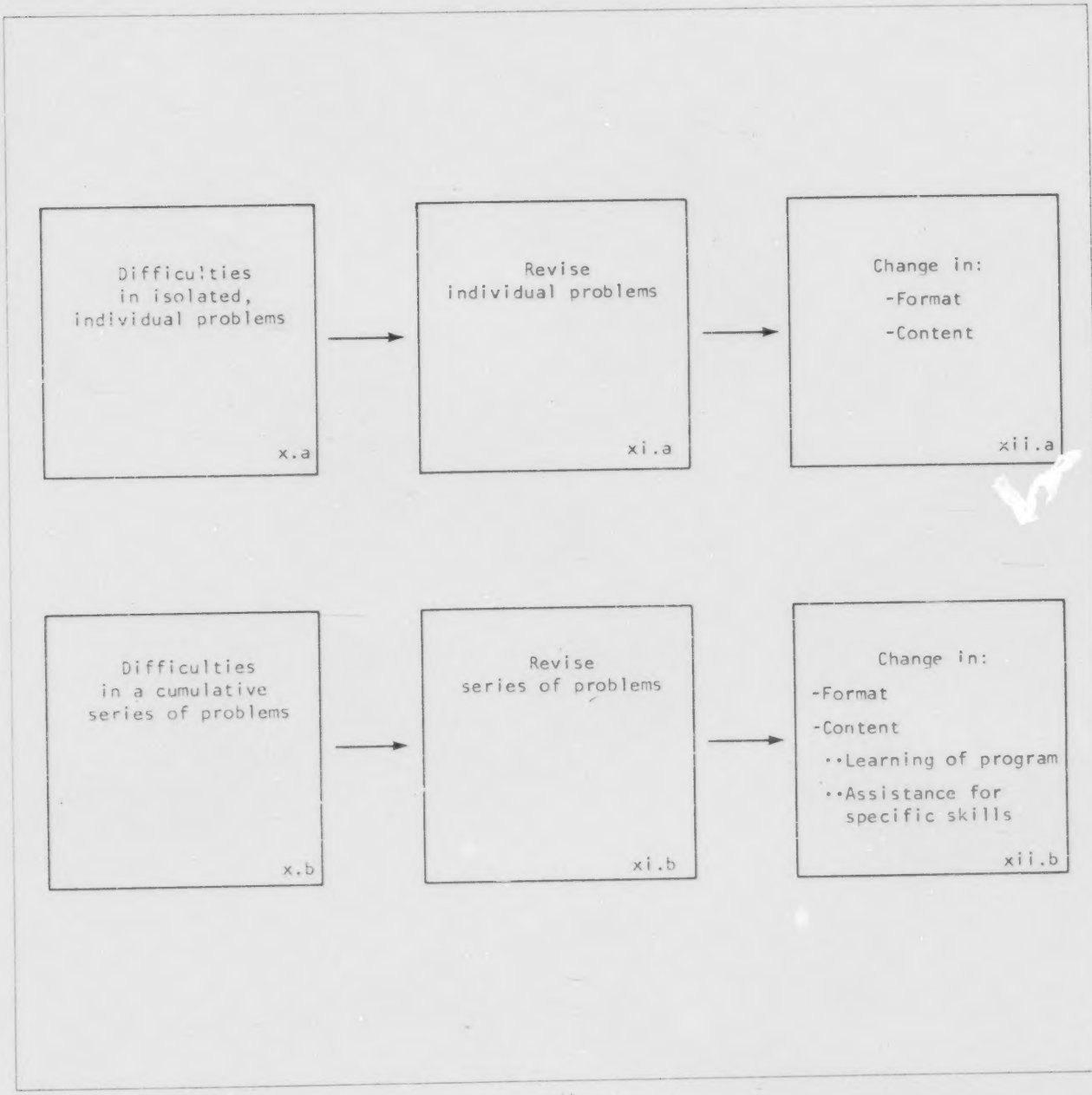
Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
Interpretation of learning failures	J.1.3	FORM J.2(1) carried forward from	J.1.3	

Sub-**STEP** J.1.4

JOB DIAGRAM





BACKGROUND INFORMATION

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Sources of program weakness likely to be associated with programs which are weak to differing extents	67
How to revise individual program problems which result in errors	68
Two sources of program weakness associated with errors on a series of program problems	69
Four types of program "leanness" which may account for errors on a series of program problems	70
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Criteria for determining priorities in the kinds of revisions which are made in the instructional program	72
Priorities in revising a series of program problems in order to make them less lean	73

J.1.4
IDENTIFICATION
MATRIX

	EXTENT OF PROGRAM WEAKNESS	
EXTENT OF PROGRAM WEAKNESS	Errors are made on INDIVIDUAL program problems	Errors are made on a CUMULATIVE SERIES of program problems
CRITERIA	*-An informal record of errors or FORM J.2(1) filled out reveals that errors are made on:* *··Isolated program problems or tasks* *··Problems involving different skills within the same portion of a chain* *··Problems involving widely separated portions of a chain* *··Problems involving preparatory behaviors or criterion behaviors but usually not both*	*-An informal record of errors or FORM J.2(1) filled out reveals that errors are made on:* *··A sequential series of program problems* *··Problems involving different examples related to the same skill being taught* *··Problems involving adjacent portions of a chain* *··Problems usually involving both the criterion behaviors and preparatory behaviors*

J.1.4
IDENTIFICATION
MATRIX

SOURCES OF PROGRAM WEAKNESS LIKELY TO BE ASSOCIATED WITH ERRORS ON INDIVIDUAL PROGRAM PROBLEMS AND ON A CUMULATIVE SERIES OF PROGRAM PROBLEMS

EXTENT OF PROGRAM WEAKNESS	Sources of program weakness likely to be associated with isolated INDIVIDUAL program problems	Sources of program weakness likely to be associated with a CUMULATIVE SERIES of program problems
CRITERIA	-*Program FORMAT* ··*Vocabulary too difficult* ··*Instructions unclear or confusing* ··*Attention-controlling techniques inadequate* -*Program CONTENT* ··*Assistance provided (i.e., cues) makes an inadequate identification of INPUTS or ACTIONS required for successful problem solution*	-*Program CONTENT* ··*The instructional sequence is excessively lean* ··*Prerequisite behavior is wrongly assumed to be in student's repertoire* ··*Prerequisite behavior to be taught in the program is taught in the wrong sequence (i.e., not taught before the criterion behavior in question as it should be)* ··*Prerequisite behavior to be taught in the program is not adequately taught*

J.1.4

DECISION MATRIX

DETERMINING HOW TO REVISE AN INDIVIDUAL PROGRAM PROBLEM ON WHICH ERRORS ARE MADE*

CONDITIONS	Error is due to FORMAT characteristics (as revealed in Sub-STEP J.1.3)	Error is due to CONTENT characteristics (as revealed in Sub-STEP J.1.3)
ACTION TO TAKE	-*Change vocabulary level and readability level to make it more suitable to the target audience:* ··*Shorter, more commonly used words* ··*Shorter sentences* -*Change problem or task instructions making them:* ··*Clearer, less ambiguous* ··*Easier to understand* -*Change attention or observation controlling devices to make them work more effectively:* ··*Simplify the devices* ··*Make features more prominent*	-*Increase the strength of assistance:* ··*Make the identification of INPUTS and ACTIONS more direct* /*If no identification is made, provide an indirect identification* /*If identification is already indirect, make it less indirect* /*Only in a beginning problem in a series should an indirect identification be replaced by a direct one* (See SECTION G, pages 90-95)

*When two or more of the informal tryout sample (of five or six students) make an error on the problem

EXAMPLES	e.g., Informal tryout has revealed that students did not know the meaning of a (non-technical) word and a word not included in the objectives for the instructional sequence *Original word used was "emasculate." Change to "weaken" or "unnerve."* e.g., A diagram was used to control the observing behavior of the student; students did not know how to use it *Change instructions so that students know where to enter the diagram, what to look at first, what to look for, what to do next, etc.*	e.g., The practice problem offers no identification of the ACTION (which is required) -*The student is required to use a verb (other than those used in prior examples) and to use the correct form for the subject noun given him. No assistance is given him.* -*On revision he is given the indirect identification--another noun and another verb: "The man walks to work."* -*In his new problem task he is given the subject noun "the dog" and is required to make up a sentence in the present tense using another verb. The example given him, i.e., "walks," provides indirect or partial identification*

J.1.4
IDENTIFICATION
MATRIX

	TWO MAJOR TYPES OF PROGRAM WEAKNESS ASSOCIATED WITH CONTENT DIFFICULTIES IN A SERIES OF PROGRAM PROBLEMS	
TYPES OF PROGRAM WEAKNESS	EXCESSIVE LEANNESS	PREREQUISITE BEHAVIORS not in student's repertoire
CRITERIA	-*The instructional program which has been prepared is too lean resulting in content difficulties*	-*Student difficulties are due to the absence from the student's repertoire of other criterion behaviors which are prerequisite to the learning of the criterion behavior in question* -*This may be due to one of two conditions:* ••*Students did not have prerequisite behaviors to begin with as may have been assumed* ••*If the prerequisite behavior is taught in the program, its sequencing relative to the criterion behavior in question is at fault*
FOR DETAIL	See next page	-Analysis of this type of weakness requires the use of data not available during informal tryout -Sequencing changes are therefore made during developmental tryout See STEP J.2

J.1.4 "LEANNESS" OF AN INSTRUCTIONAL SEQUENCE IS A FUNCTION OF FOUR PROGRAM VARIABLES

IDENTIFICATION MATRIX

VARIABLES	1 SIZE OR AMOUNT of criterion behavior practiced at the same time	2 DEGREE OF ASSISTANCE provided	3 SPEED OF FADING OF ASSISTANCE	4 NUMBER OF PRACTICE PROBLEMS provided in the instructional sequence
CRITERIA	-*The larger the unit of practice (i.e., the more of the criterion behavior practiced at the same time), the leaner the sequence* -*The order of leanness of a program for the following "units" is from most to least lean:* ··*Practice of a group of two or more Sub-STEPS* ··*Practice of one Sub-STEP* ··*Practice of component skills within a Sub-STEP* ··*Practice of individual component skills*	-*The less direct assistance is in a given program problem or in a series of program problems, the leaner the sequence* -*The order of leanness for the following types of assistance is from most to least lean:* ··*No assistance* ··*Indirect assistance* ··*Direct assistance*	-*The more quickly assistance is withdrawn the leaner the program* -*The more quickly the degree of assistance is weakened, the leaner the program*	-*The fewer the practice problems in the whole sequence, the leaner the program*
SEE SECTION	"I" page 12	"I" page 52	"I" page 53	"I" page 54

J.1.4 DETERMINING HOW TO REVERSE THE LEANNESS OF A PROGRAM SEQUENCE

DECISION MATRIX

VARIABLES	1 SIZE OR AMOUNT of criterion behavior practiced at the same time	2 DEGREE OF ASSISTANCE provided	3 SPEED OF FADING OF ASSISTANCE	4 NUMBER OF PRACTICE PROBLEMS provided in the instructional sequence
ACTION TO TAKE	*-Create a sequence which is <u>one</u> step <u>down</u> the "leanness" ladder from the one just tried out:* *··If two or more Sub-STEPS were practiced together, reduce the number of Sub-STEPS practiced together;* *··If two Sub-STEPS were practiced together, sequence practice of just one;* *··If one Sub-STEP was practiced, require practice of a combination of component skills;* *··If a combination of component skills were practiced, require practice of <u>individual</u> component skills*	*-Create a sequence in which assistance is less lean than that just used in the program which was tried out:* *··If <u>no</u> assistance was provided, provide indirect assistance* *··If indirect assistance was provided, provide still less indirect assistance* *··Finally, provide direct assistance*	*-Create a sequence in which assistance is faded out less abruptly than in the program just tried out:* *··Continue assistance problems before:* */Weakening it (making it less and less direct)* *OR* */Removing it altogether*	*-Create a sequence in which there are more practice problems than in the program just tried out:* *··Add extra problems into a sequence*

CAUTION	Do <u>not</u> in the first revision reverse the leanness of the program too quickly or <u>too</u> much by any of these approaches. See next page for priorities in the use of these four approaches.

J.1.4

IDENTIFICATION MATRIX

CRITERIA FOR DETERMINING PRIORITIES IN WAYS TO REVISE INSTRUCTIONAL SEQUENCES IN ORDER TO MAKE THEM LESS LEAN

VARIABLES	EFFICIENCY of an instructional sequence	EFFECTIVENESS of an instructional sequence
CRITERIA	-*Revision should be consistent with the efficiency of the instructional sequence; the sequence is more efficient:* ··*The shorter it is (i.e., the fewer problems there are),* ··*The less time it takes to complete* -*Revision should keep the instructional sequence as lean as is possible, consistent with "EFFECTIVENESS"* -*Revision should not add any more than is required* -*Accordingly, each cycle of revision should make minimal changes away from leanness*	-*Revision must result in an instructional sequence which now produces minimal number of errors:* ··*Few program problems produce errors* ··*Few students out of total tryout population make errors on program problems* -*Revision should be geared to the type of learning difficulties occurring--but consistent with the criterion of "EFFICIENCY"*

J.T.4
DECISION
MATRIX

DETERMINING PRIORITIES AMONG THE FOUR WAYS
TO REVISE PROGRAM SEQUENCES TO MAKE THEM LESS LEAN

PRIORITIES	1st priority occurring in the FIRST revision cycle	2nd priority occurring in the SECOND revision cycle	3rd priority occurring in the THIRD revision cycle
ACTION TO TAKE	-*Keep "the AMOUNT of criterion behavior practiced at the same time" unchanged* -*Consider one or more of the following approaches:* ··*Strengthen the degree of assistance to the program problems already in the sequence and/or remove assistance less early in the sequence* *OR* ··*Introduce new program problems to the sequence providing more examples (new or repetitions)*	IF THE SECOND TRYOUT STILL PRODUCES ERRORS ON A SERIES OF PROGRAM PROBLEMS: -*Keep "the AMOUNT of criterion behavior practiced at the same time" unchanged* -*Definitely add new program problems appropriate to the skills with which students have difficulties. (Intersperse the new problems among the existing problems)* -*Also consider strengthening the degree of assistance for existing problems*	IF THE THIRD TRYOUT STILL PRODUCES ERRORS ON A SERIES OF PROGRAM PROBLEMS: -*Reduce the amount of criterion behavior practiced at the same time (one level lower on each successive revision)* -*Also consider adding new program problems*

EXAMPLES	SEE SECTION "I," PAGES 73-96 FOR EXAMPLES OF PROGRAM SEQUENCES DIFFERING IN "AMOUNT" OF CRITERION BEHAVIOR PRACTICED AT THE SAME TIME

REVISING PROGRAM PROBLEMS
FOR SPECIFIC TYPES OF LEARNING DIFFICULTIES

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Ways to revise program to overcome "association" difficulties	80
Ways to revise program to overcome "chaining" difficulties	81

J.1.4

IDENTIFICATION **MATRIX**

HOW REVISION OF "DEGREE OF ASSISTANCE" AND OF "NUMBER OF EXAMPLES" IS USED TO OVERCOME DIFFICULTIES IN A PROGRAM PROBLEM*

TYPE OF REVISION	STRENGTHENING THE DEGREE OF ASSISTANCE	ADDING NEW PROGRAM PROBLEMS
CRITERIA	*-Cues or prompts are added which provide more direct identifications of:* *··INPUTS/OUTPUTS to be discriminated and/or the properties which form the basis for the discrimination* *··INPUTS/OUTPUTS requiring generalization and/or the properties which form the basis for the generalization* *··Which ACTION goes with which INPUT (associations)* *··The sequence of associations to be chained*	*-New program problems are added or old problems are repeated giving the student additional practice:* *··Discriminating between new/old examples of INPUTS (or OUTPUTS)* *··Generalizing across new/old examples of INPUTS (or OUTPUTS)* *··Associating new/old examples of INPUTS with ACTIONS* *··Producing a chained sequence of associations*

*These revision approaches apply both to isolated problem problems (on which errors occur) or on program problems which are part of a series

EXAMPLES	SEE PAGES 77-81

J.1.4

IDENTIFICATION MATRIX

	TWO APPROACHES TO CONSIDER IN MAKING REVISIONS	
APPROACHES	Use the SAME practice progression selected in TASK "G" appropriate to the learning difficulties	Consider using NEW practice progression appropriate to the learning difficulties
CRITERIA	-*The strengthening of assistance or the addition of new examples is done within the framework of practice progressions selected in TASK "G"* SEE PAGES 71-149 IN SECTION "G" OF THE HANDBOOK	-*The strengthening of assistance or the addition of new examples is done within the framework of new practice progressions selected now as a means of reducing learning difficulties* -*The new progressions are selected because of empirical evidence that the difficulty is greater than initially anticipated*
EXAMPLES	e.g., -*The progression selected originally was a "mode" progression involving only editing and production practice; to add to this, recognition practice might also be included to make the sequence easier* -*A sequence devoted to practice of discriminations initially used paired examples--first differing widely, then gradually narrowed. The revision might include additional problems in which the reduction in differences between pairs is still more gradual*	e.g., -*The original sequence may have provided only for production practice (no mode progression involved). The addition of recognition and editing practice is now selected because of the demonstrated difficulty of the learning problem*

J.1.4
IDENTIFICATION
MATRIX

WAYS TO REVISE A PROGRAM SEQUENCE
AS A MEANS OF OVERCOMING "DISCRIMINATION" DIFFICULTIES

REVISION APPROACHES	Adding ASSISTANCE within an already selected progression *	Adding PROBLEMS within an already selected progression *	Using other progressions which are appropriate
CRITERIA	-*Providing as a model contrasting examples of INPUTS which belong to a class and those which do not* -*Providing as a model contrasting examples of INPUTS which belong to different classes* -*Providing verbal rules which identify when one class begins and another leaves off* -*Using cues (visual or verbal) calling attention to properties which determine whether INPUTS belong to one class or another*	-*Providing additional program problems in which new examples of INPUTS from different classes are used (and about which the student practices making relevant discriminations)* -*Providing additional program problems which repeat the use of examples already used*	-*Providing recognition practice in which pairs of examples belonging to different classes and to the same class are contrasted and/or compared (Progression b)* -*Using diagrams to highlight the differences between classes (Progression i)* -*Using widely contrasting examples and gradually narrowing differences to permit fine discriminations (Progression k)*

*These two approaches are often combined.

FOR EXAMPLES SEE PAGES	94-95 in SECTION "G"	109-113 in SECTION "G"	See Sub-STEP G.2.1 in SECTION "G"

J.1.4
IDENTIFICATION
MATRIX

WAYS TO REVISE A PROGRAM SEQUENCE
AS A MEANS OF OVERCOMING "GENERALIZATION" DIFFICULTIES

REVISION APPROACHES	Adding ASSISTANCE within an already selected progression *	Adding PROBLEMS within an already selected progression *	Using other progressions which are appropriate
CRITERIA	-*Providing as a model contrasting examples of INPUTS which belong to a class and those which do not* -*Providing as a model pairs of comparable INPUTS which belong to the same class* -*Providing verbal rules which identify when one class begins and another leaves off* -*Using cues (visual or verbal) calling attention to properties which determine whether INPUTS belong to one class or another*	-*Providing additional program problems (in which new examples of INPUTS from the same class are used (and about which the student practices making relevant generalizations)* -*Providing additional program problems which repeat the use of examples already used*	-*Providing recognition practice in which pairs of examples belonging to different classes and to the same class are contrasted and/or compared (Progression b)* -*Using diagrams to highlight the similarities within a class (Progression i)*

*These two approaches are often combined

FOR EXAMPLES SEE PAGES	94-95 in SECTION "G"	109-113 in SECTION "G"	See Sub-STEP G.2.1 in SECTION "G"

J.1.4
IDENTIFICATION
MATRIX

WAYS TO REVISE A PROGRAM SEQUENCE
AS A MEANS OF OVERCOMING "ASSOCIATION" DIFFICULTIES

REVISION APPROACHES	Adding ASSISTANCE within an already selected progression *	Adding PROBLEMS within an already selected progression *	Using other progressions which are appropriate
CRITERIA	*-Providing as a model an example from each INPUT class and the ACTION to be associated with it (to be done for all classes)* *-Providing a verbal rule indicating how INPUT and ACTIONS are associated*	*-Providing additional program problems with which the student gains further practice in associating INPUTS and ACTIONS:* *••Repetition of old (INPUT) examples* *OR* *••New (INPUT) examples*	*-Providing recognition practice in which, when given an INPUT, the student merely has to select a correct ACTION from two or more options (Progression h)* *-Using diagrams to give an overview of which ACTION goes with which INPUT class (Progression i)*
FOR EXAMPLES SEE PAGES	94-95 in SECTION "G"	109-113 in SECTION "G"	See Sub-STEP G.2.1 in SECTION "G"

*These two approaches are often combined.

J.1.4

IDENTIFICATION MATRIX

WAYS TO REVISE A PROGRAM SEQUENCE AS A MEANS OF OVERCOMING "CHAINING" DIFFICULTIES

REVISION APPROACHES	Adding ASSISTANCE within an already selected progression *	Adding PROBLEMS within an already selected progression *	Using other progressions which are appropriate
	-*Providing a model performance of the whole chain which the student can initate* -*Providing verbal rules indicating the proper sequence in which the separate associations are chained* -*Providing verbal or visual cues which help identify which association is next up in the sequence*	-*Providing additional practice in producing the whole chain*	-*Providing recognition practice in which the student has to select from options which association comes next in the chain (Progression b)* -*Using diagrams to give an overview of a conceptual chain or a flow pattern of a procedural chain (Progression i)*

*These two approaches are often combined.

JOB PROCEDURES

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Deciding how to approach revision	85
SUMMARY OF PROCEDURES	86
Adequacy of approach to revision	87

J.1.4 IDENTIFICATION MATRIX	INFORMATION SOURCES TO REVIEW AND WHAT TO LOOK FOR AS A BASIS FOR PROGRAM REVISION	
SOURCES	OBSERVATIONAL DATA recorded on actual program AND recorded on FORM J.2(1) and interpretation of student difficulties in Sub-STEP J.1.3	PROBING DATA obtained in Sub-STEP J.1.2 AND interpretation of student difficulties in Sub-STEP J.1.3
CRITERIA	*-Identification of extent of student errors:* *··On individual, isolated program problems* *OR* *··On a cumulative series of program problems* *-Identification of:* *··Type of student difficulties* *··Sources of the difficulties:* */Content difficulties* */Format difficulties*	*-Identification of:* *··Type of student difficulties* *··Sources of the difficulties:* */Content difficulties* */Format difficulties*

J.1.4

DECISION MATRIX

DETERMINING HOW TO DEAL WITH WEAKNESSES IN PROGRAM:
ON INDIVIDUAL PROGRAM PROBLEMS
AND ON A SERIES OF PROGRAM PROBLEMS

CONDITIONS	Student errors occur on individual, isolated program problems	Student errors occur on a cumulative series of program problems
ACTION TO TAKE	-*Make format changes appropriate to identified difficulties:* ··*In vocabulary, or in sentence complexity, etc.* ··*In ambiguity of task instructions* ··*In ambiguity of attention or observation controlling devices* -*Make content changes appropriate to type of content difficulty (i.e., type of component skill not learned):* ··*Improve old progressions used or use new progressions* ··*Strengthen assistance or provide new examples*	-*Make content changes appropriate to extent of problem; decrease leanness of program by:* ··*Strengthening assistance* ··*Adding program problems* ··*And, on final cycles of revision, reduce the amount of criterion behavior practiced at the same time* -*Within the series, for each program problem make content changes appropriate to type of content difficulty (i.e., type of component skill not learned):* ··*Improve old progressions used or use new progressions* ··*Strengthen assistance or provide new examples*

J.1.4

ILLUSTRATION SUMMARIZING PROCEDURES INVOLVED IN IDENTIFYING PROGRAM WEAKNESSES AND MAKING APPROPRIATE REVISIONS

#1

REVIEW

a. Observational data recorded on FORM J.2(1)

b. Observational data and probing data

#2

IDENTIFY

b. Extent of program weakness

b. Type of student difficulty and the sources of the difficulty

#3

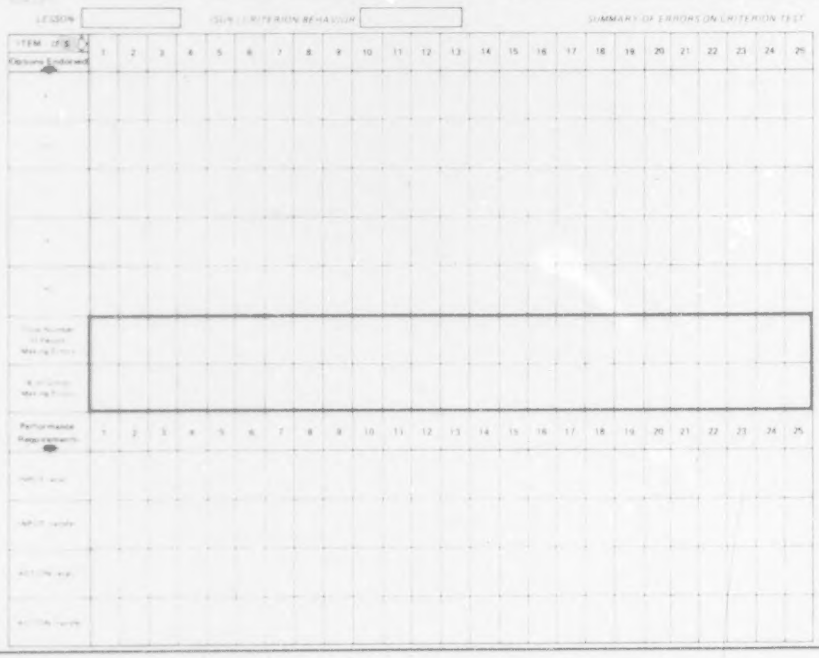
REVISE instructional sequence

a. Reflecting the difficulty identified for each program problem

and/or

b. Reflecting the difficulty in a cumulative series of program problems

FORM J.2(1)



J.1.4
STANDARDS
MATRIX

ASSESSING THE ADEQUACY IN APPROACH
TO REVISION OF IDENTIFIED PROGRAM WEAKNESSES

PROPERTIES	1 DATA-BASED	2 EFFECTIVENESS	3 EFFICIENCY
CRITERIA	-*Revisions made are closely geared to errors identified from* -*Observational data:* ··*Errors on isolated program problems* ··*Errors on a cumulative series of program problems* -*Probing data and observational data:* *Errors in learning specific component skills (content difficulties)* *Format difficulties:* */Vocabulary* */Instructions* */Attention-controlling devices*	-*Techniques used for revision consist of:* ··*Using progressions originally selected for specific learning problems, OR selecting new ones when errors persist on cyclically tryouts* ··*Reducing leanness of program by adding:* */Stronger assistance* */More practice problems* -*The instructional sequence in its final cyclical revision is relatively error-free; i.e., errors are made on fewer than 15-20% of the program problems*	-*Revisions are made in such a way as to keep the instructional sequence as lean as possible, compatible with the goal of producing an effective sequence:* ··*The amount of criterion behavior practiced at the same time, only as a last resort after other revision strategies (See Column #2) fail in early revisions*

STEP J.1

COMPLETION CHECKLIST

	IDENTIFIED	PERFORMED	PRODUCED	FORMS COMPLETED
J.1.1	Enter proficiency of informal tryout sample	Administration of a "before" test		
J.1.2	Errors on program	Administration of instructional program		FORM J.2(1) (optional)
J.1.3		Interpreted nature of learning failures		
J.1.4			Revised version of program	

STEP J.2

J.2 Conduct a developmental tryout of the instructional program and revise the program when necessary.*

J.2.1 Administer the criterion and sub-criterion tests to a representative sample of the target population as a "before" test.

J.2.2 Administer the instructional program to the representative sample and identify the portions of the program on which errors are made.

J.2.3 Administer criterion and sub-criterion tests to the representative sample as an "after" test, identify errors, and, whenever possible, interpret learner difficulties which have resulted in errors.

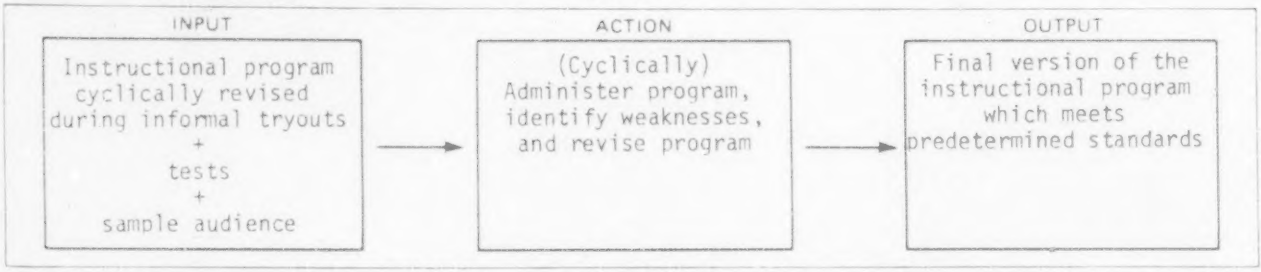
J.2.4 Administer diagnostic tests and/or conduct interviews to identify learner difficulties which have resulted in the errors which have been made.

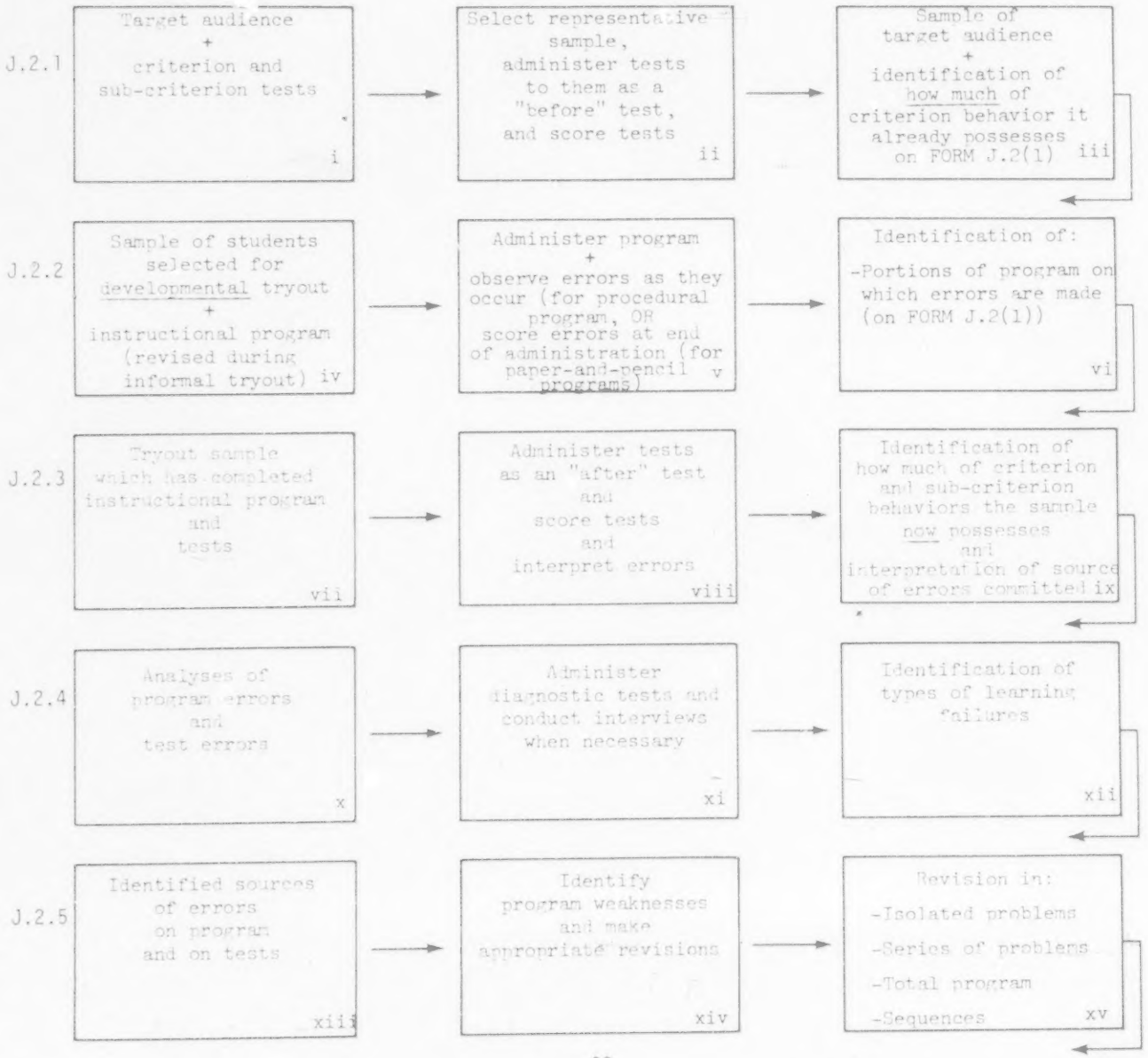
J.2.5 Make revisions in the instructional program based on program and test error data and on identified sources of errors.

**The cycle of Sub-STEPS J.2.1, J.2.2, J.2.3, J.2.4, and J.2.5 should be repeated until a predetermined standard of performance is attained by a predetermined percentage of a representative sample.*

STEP J.2

OVERVIEW


INPUT
ACTION
OUTPUT
Instructional program cyclically revised during informal tryouts + tests + sample audience
(Cyclically) Administer program, identify weaknesses, and revise program
Final version of the instructional program which meets predetermined standards


J.2.1
Target audience + criterion and sub-criterion tests
i
Select representative sample, administer tests to them as a "before" test, and score tests
ii
Sample of target audience + identification of how much of criterion behavior it already possesses on FORM J.2(1)
iii
J.2.2
Sample of students selected for developmental tryout + instructional program (revised during informal tryout)
iv
Administer program + observe errors as they occur (for procedural program, OR score errors at end of administration (for paper-and-pencil programs)
v
Identification of: -Portions of program on which errors are made (on FORM J.2(1))
vi
J.2.3
Tryout sample which has completed instructional program and tests
vii
Administer tests as an "after" test and score tests and interpret errors
viii
Identification of how much of criterion and sub-criterion behaviors the sample now possesses and interpretation of source of errors committed
ix
J.2.4
Analyses of program errors and test errors
x
Administer diagnostic tests and conduct interviews when necessary
xi
Identification of types of learning failures
xii
J.2.5
Identified sources of errors on program and on tests
xiii
Identify program weaknesses and make appropriate revisions
xiv
Revision in: -Isolated problems -Series of problems -Total program -Sequences
xv

STEP J.2

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J.2.2			-MATRIX: Adequacy of program administration and identification of errors 105	FORM J.2(1) SUMMARY OF PROCEDURES . . 104
J.2.3	-MATRIX: Assessing proficiency . . . 111 -MATRIX: GROUP results . . . . . 117 -MATRIX: INDIVIDUAL results . . . . 125 -MATRIX: Delayed assessment . . . . 151 -MATRIX: Assessing "sequencing" . . 155		-MATRIX: Adequacy of interpretation of errors on "after" tests 163	FORM J.2(1) FORM J.2(2) FORM J.2(3) SUMMARY OF PROCEDURES . . 162
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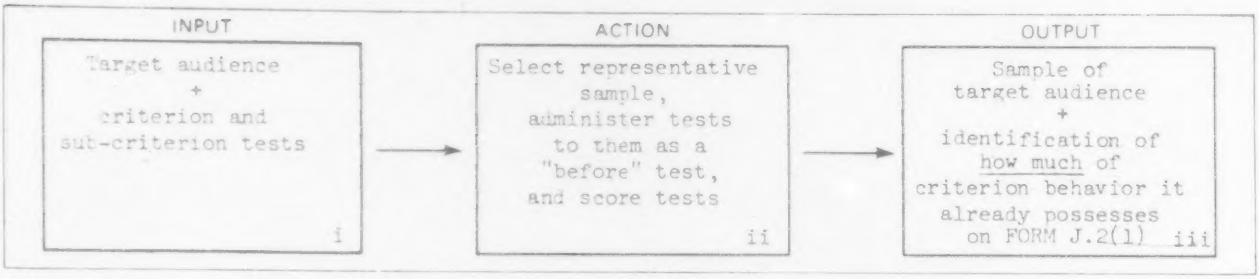
PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*What the target audience can already do before receiving instruction is identified.*
WHAT YOU WILL WORK FROM	(1) The target audience (2) Criterion and sub-criterion tests
WHAT YOU WILL DO	(1) Select a representative sample from the target audience (n = approximately 25 students). (2) Administer and score the tests (a BEFORE test). (3) Identify what portions of the criterion behavior the sample already can exhibit.
FORMS YOU WILL USE	FORM J.2(1) for recording errors on tests.

DESCRIPTION OF Sub-STEP	J.2.1



Job Aid Contents

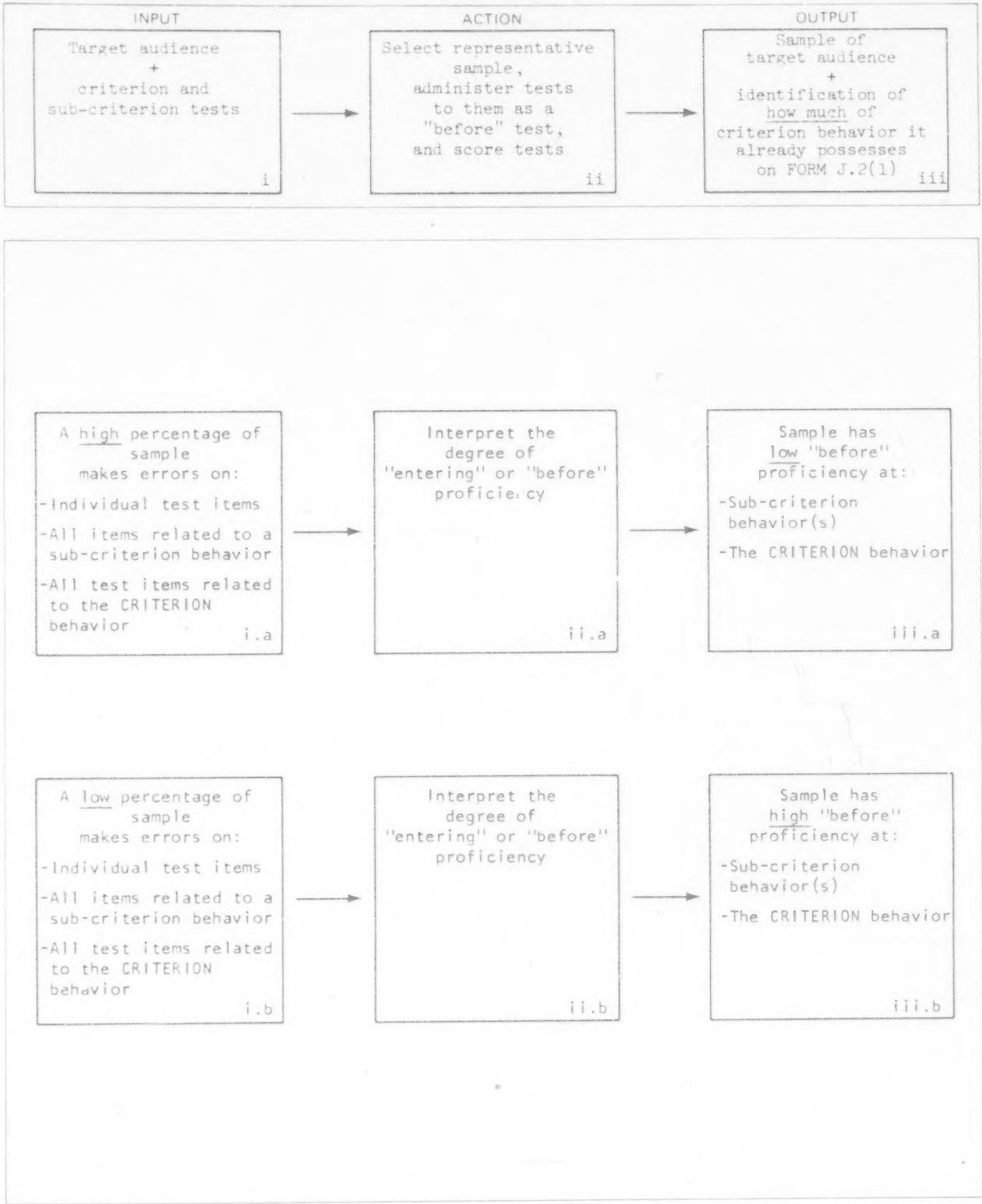
CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
	-MATRIX: How to identify "before" proficiency . . 96	-MATRIX: Adequacy of sample reaction and use of "before" test results 99	FORM J.2(1) SUMMARY OF PROCEDURES . . 98

Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
Identification of audience characteristics	J.1.1	Tests on FORM F.2(1) (carried forward from)	J.1.1	FORM J.2(1)

Sub-STEP J.2.1

JOB DIAGRAM


INPUT
ACTION
OUTPUT
Target audience + criterion and sub-criterion tests
i
Select representative sample, administer tests to them as a "before" test, and score tests
ii
Sample of target audience + identification of how much of criterion behavior it already possesses on FORM J.2(1)
iii
A high percentage of sample makes errors on:
-Individual test items
-All items related to a sub-criterion behavior
-All test items related to the CRITERION behavior
i.a
Interpret the degree of "entering" or "before" proficiency
ii.a
Sample has low "before" proficiency at:
-Sub-criterion behavior(s)
-The CRITERION behavior
iii.a
A low percentage of sample makes errors on:
-Individual test items
-All items related to a sub-criterion behavior
-All test items related to the CRITERION behavior
i.b
Interpret the degree of "entering" or "before" proficiency
ii.b
Sample has high "before" proficiency at:
-Sub-criterion behavior(s)
-The CRITERION behavior
iii.b

JOB PROCEDURES

	page
Identifying "before" proficiency	96, 97
SUMMARY OF PROCEDURES	98
Adequacy of sample selection and use of "before" test results	99

J.2.1
DECISION
MATRIX

DETERMINING "BEFORE" PROFICIENCY BASED ON THREE TYPES OF INFORMATION

TYPES OF MEASURES	Proficiency on INDIVIDUAL test items	Proficiency on all test items related to each SUB-CRITERION behavior	Proficiency on all test items related to each CRITERION behavior
ACTION TO TAKE	*-Record on FORM J.2(1) the number of students making an error on each test item* *-(For multiple choice test items, enter number of students selecting each wrong option)* *-Express the number (of students making errors) as a percent of the total sample; enter on "percent" row of FORM J.2(1)*	*-Taking the values from the "percent" row on FORM J.2(1), add the percentages for all test items related to each sub-criterion behavior* *-Divide this sum by the number of test items related to each sub-criterion behavior* *-This produces an average error score for each sub-criterion behavior*	*-Taking the values from the "percent" row on FORM J.2(1), add the percentages for all test items related to the CRITERION behavior* *-Divide this sum by the number of test items related to the CRITERION behavior* *-This produces an average error score for the CRITERION behavior*
EXAMPLE (See opposite page)	-The number of people making an error on each test item is filled in in the first row; e.g., 24 students made an error on Item #4	-Test items 10-15 all relate to sub-criterion behavior #2 -The sum of the percentages for each of these items (48, 56, 60, 36, 52, and 44) equals 296 -There are 6 items -296 divided by 6 yields an average error rate of 49% on all items related to this sub-criterion behavior -This means that 51% of the sample is proficient at this sub-criterion behavior	-Test items 22-25 all relate to the CRITERION behavior -The sum of the percentages for each of these items (90, 96, 96, and 84) equals 366 -There are 4 items -366 divided by 4 yields an average error rate of 91% on all items related to the CRITERION behavior -This means that 09% of the sample is proficient at the CRITERION behavior

Items 1-9 all measure proficiency at Sub-Criterion Behavior #1

Items 10-15 all measure proficiency at Sub-Criterion Behavior #2

Items 16-21 all measure proficiency at Sub-Criterion Behavior #3

Items 22-25 all measure proficiency at the CRITERION BEHAVIOR

Form J 2(1)

LESSON _____ (SUB-) CRITERION BEHAVIOR _____

SUMMARY OF ERRORS ON CRITERION TEST

ITEM #'S / Options Endorsed	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
a *	20	20	23	24	25	25	21	20	22	12	14	15	9	13	11	19	24	22	25	14	20	22	24	24	21
b																									
c																									
d																									
e																									
Total Number of People Making Errors	20	20	23	24	25	25	21	20	22	12	14	15	9	13	11	19	24	22	25	14	20	22	24	24	21
** % of Group Making Errors	80	80	92	96	100	100	84	80	90	48	56	60	36	52	44	76	96	90	96	56	80	90	96	96	84
Performance Requirements	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
INPUT recall																									
INPUT transfer																									
ACTION recall																									
ACTION transfer																									

Average error*** across test items for:

Sub-Criterion #1
$\bar{x}$ = 88%

Sub-Criterion #2
$\bar{x}$ = 49%

Sub-Criterion #3
$\bar{x}$ = 82%

CRITERION
$\bar{x}$ = 91%

***in percentages (of the sample)

*The test is a "production" test, not a "multiple choice" test; therefore, only one row is filled in.

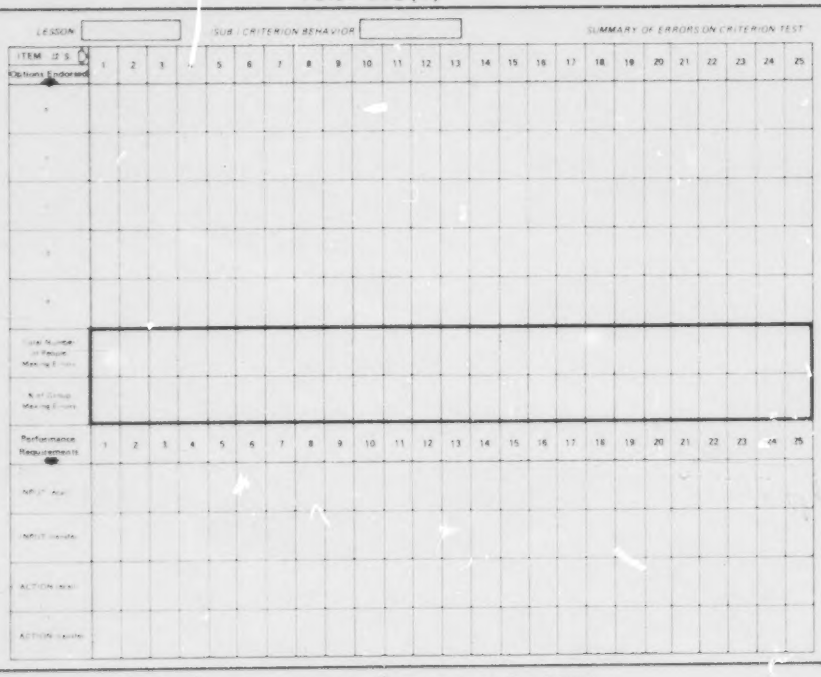
**25 students are used in this developmental tryout.

J.2.1

ILLUSTRATION SUMMARIZING PROCEDURES INVOLVED IN SELECTING A SAMPLE, ADMINISTERING AND SCORING "BEFORE" TESTS

#1	#2	#3
SELECT SAMPLE a. Select sample of approximately 25-50 students from the target audience b. Make sure sample is representative* (random selection can assure this) *See Sub-STEP J.1.1 for discussion of sample selection.*	ADMINISTER AND SCORE TESTS a. Administer sub-criterion tests and criterion tests to sample b. Score tests c. Record error results by test items on top half of FORM J.2(1) *See Sub-STEP J.1.2 for discussion of use of FORM J.2(1).*	IDENTIFY "BEFORE" PROFICIENCY a. Review scores for all test items related to <u>each</u> sub-criterion behavior b. Sum results for <u>each</u> sub-criterion behavior c. Determine which students are already proficient at the sub-criterion behavior and how many of the total group are proficient d. Repeat a-c for each sub-criterion behavior and for the criterion behavior

FORM J.2(1)


LESSON
SUB / CRITERION BEHAVIOR
SUMMARY OF ERRORS ON CRITERION TEST
ITEM #'S
Options Endorsed
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Performance Requirement
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

Proficiency at criterion behavior <u>may</u> range from zero to 100%.

J.2.1
STANDARDS
MATRIX

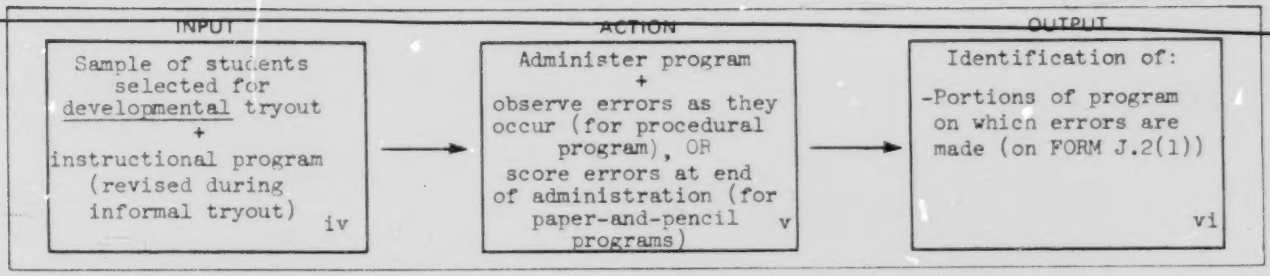
ASSESSING THE ADEQUACY OF SAMPLE SELECTION AND ADMINISTRATION OF "BEFORE" TESTS

PROPERTIES	SAMPLING adequacy	SCORING adequacy
CRITERIA	-*Sample size:* ••*Sample consists of approximately 20-25* -*Sample representativeness; sample compares with the target audience in:* ••*Range of general ability* ••*Range of specific abilities (relevant to mastery of the criterion behavior)* ••*Range of entering proficiency on the criterion behavior*	*A record is provided on FORM J.2(1) of:* -*The number of students committing errors on:* ••*Each test item* ••*Specific options in multiple choice tests* -*The percentage of students in the total sample committing (some type of) errors* -*The number and percentage of students committing errors on:* ••*All items related to each sub-criterion behavior* ••*All items related to the complete criterion behavior*

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*A record of the percentage of students in the sample who make errors on each part or problem in the program.*
WHAT YOU WILL WORK FROM	(1) Sample of approximately 25 students (2) The instructional program (revised on the basis of informal tryouts)
WHAT YOU WILL DO	(1) Administer the program (2) Score and identify errors (3) Compute percentage of errors made on individual problems and on the whole program
FORMS YOU WILL USE	FORM J.2(1) for recording errors on the instructional program.

DESCRIPTION OF Sub-STEP	J.2.2



Job Aid Contents

CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
		-MATRIX: Adequacy of program administration and identification of errors 105	FORM J.2(1) SUMMARY OF PROCEDURES . . 104

Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
Revised instructional program	J.1			FORM J.2(1)

Sub-STEP J.2.2

JOB DIAGRAM

INPUT	ACTION	OUTPUT
Sample of students selected for developmental tryout + instructional program (revised during informal tryout) iv	Administer program + observe errors as they occur (for procedural program), OR score errors at end of administration (for paper-and-pencil programs) v	Identification of: -Portions of program on which errors are made (on FORM J.2(1)) vi

		IDENTIFICATION OF
Individual program problems i.a	Score for whole tryout sample and compute percentage making errors on FORM J.2(1) ii.a	Percentage of students committing an error on each program problem iii.a
All program problems related to each sub-criterion behavior i.b	Score for whole tryout sample and compute percentage making errors on FORM J.2(1) ii.b	Identification of percentage of students committing errors on all program problems relating to each sub-criterion behavior iii.b
All program problems related to the CRITERION behavior i.c	Score for whole tryout sample and compute percentage making errors on FORM J.2(1) ii.c	Identification of percentage of students committing errors on all program problems relating to the CRITERION behavior iii.c

JOB PROCEDURES

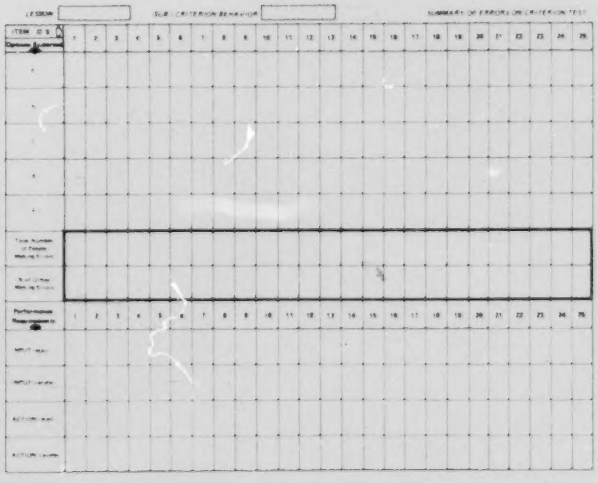
	page
SUMMARY OF PROCEDURES	104
Assessing adequacy of identification of errors committed on program	105

J.2.2

ILLUSTRATION SUMMARIZING PROCEDURES INVOLVED IN ADMINISTERING INSTRUCTIONAL PROGRAM AND IDENTIFYING PROGRAM PROBLEMS ON WHICH ERRORS ARE MADE

#1	#2	#3
ADMINISTER PROGRAM	OBSERVE AND/OR SCORE ERRORS	IDENTIFY PROFICIENCY
a. Administer instructional program to entire tryout sample: ••Simultaneously to all, if the program is on paper-and-pencil ••One-by-one if the program involves a set of procedures	a. Score errors for each (paper-and-pencil) program problem after program completion b. For "procedural" programs, observe practice and make a record of problems on which errors are made c. Make a record of program problems or program parts on which errors are made (on FORM J.2(1))	a. Compute percentages total sample makes errors on ••Each program problem b. Identify percentages on those program problems which provide no assistance and are a test of the sub-criterion behavior c. Identify percentages on those program problems which provide no assistance and are a test of the CRITERION behavior

FORM J.2(1)



J.2.2

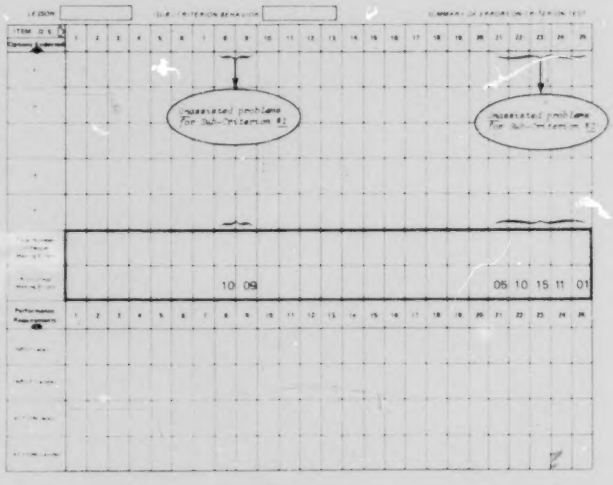
STANDARDS
MATRIX

ASSESSING THE ADEQUACY WITH WHICH PROGRAM ERRORS ARE IDENTIFIED

PROPERTIES	COMPLETENESS OF RECORD	DIAGNOSTIC CAPABILITY
CRITERIA	*On FORM J.2(1) there is a record indicating the percentage of students* *••Making errors on each program problem or program task* *••Making errors on problem parts (for multipart problems)* *••Making errors by selecting specific wrong options (on multiple choice program problems)*	*On FORM J.2(1) there are identifying marks which indicate* *••Which program problems provide no assistance and are therefore tests of each sub-criterion behavior* *••Which program problems provide no assistance and are therefore parts of the CRITERION behavior*

FORM J.2(1)

EXAMPLE



Form J.2(1)

LESSON [ ] (SUB-) CRITERION BEHAVIOR [ ]

SUMMARY OF ERRORS ON CRITERION TEST

ITEM #'S / Options Endorsed	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
a.																									
b.																									
c.																									
d.																									
e.																									
Total Number of People Making Errors																									
% of Group Making Errors																									
Performance Requirements / 1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
INPUT recall																									
INPUT transfer																									
ACTION recall																									
ACTION transfer																									

106/108

Form J.2(1)

LESSON _____ (SUB-) CRITERION BEHAVIOR _____

SUMMARY OF ERRORS ON CRITERION TEST

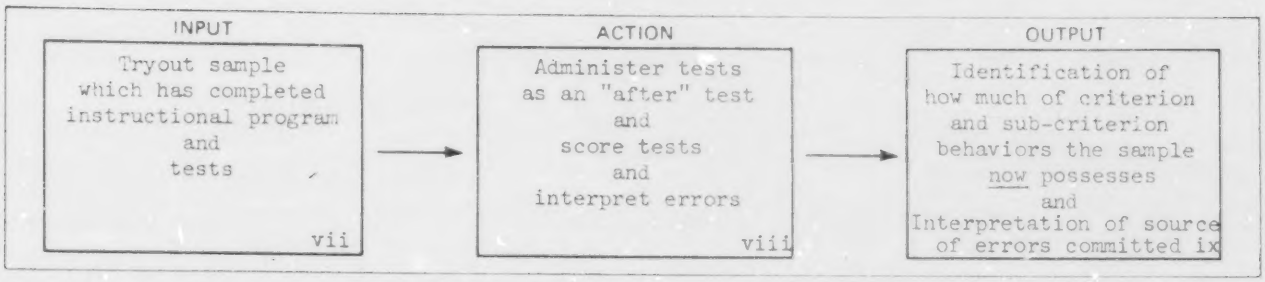
ITEM #'S / Options Endorsed	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
a.																									
b.																									
c.																									
d.																									
e.																									
Total Number of People Making Errors																									
% of Group Making Errors																									

Performance Requirements	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
INPUT recall																									
INPUT transfer																									
ACTION recall																									
ACTION transfer																									

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	--*An identification of how much of the criterion behavior the sample of students has learned as a result of taking the instructional program.* --*An interpretation of the sources of or reasons for errors committed on the program.*
WHAT YOU WILL WORK FROM	(1) Sample of students who have completed the instructional program. (2) Criterion and sub-criterion tests.
WHAT YOU WILL DO	(1) Administer tests as an AFTER test. (2) Score tests and identify errors. (3) Identify causes of errors.
FORMS YOU WILL USE	FORM J.2(1) for recording errors on tests FORM J.2(2) for identifying error patterns FORM J.2(3) for identifying error patterns

DESCRIPTION OF Sub-STEP	J.2.3


INPUT
Tryout sample which has completed instructional program and tests
vii
ACTION
Administer tests as an "after" test and score tests and interpret errors
viii
OUTPUT
Identification of how much of criterion and sub-criterion behaviors the sample now possesses and Interpretation of source of errors committed ix

Job Aid Contents

CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
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Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
Criterion and sub-criterion tests	J.2.1			FORM J.2(1) FORM J.2(2) FORM J.2(3)

Sub-STEP J.2.3

JOB DIAGRAM

INPUT	ACTION	OUTPUT
Tryout sample which has completed instructional program and tests (vii)	Administer tests as an "after" test and score tests and interpret errors (viii)	Identification of how much of criterion and sub-criterion behaviors the sample now possesses and interpretation of source of errors committed (ix)
GROUP error results: -Total test scores -RECALL and TRANSFER scores -Scores on INDIVIDUAL test items (vii.a)	Assess GROUP proficiency and identify types of errors (viii.a)	-Amount of degree of GROUP proficiency -Identification of type and frequency of errors (ix.a)
Error results for INDIVIDUAL students: -Pattern of errors: ··Mismatching of classes of INPUTS and ACTIONS (vii.b)	Assess INDIVIDUAL proficiency and identify types of learning failures to account for errors (viii.b)	-Identification of types of learning failures: ··Discriminations ··Generalizations ··Associations (ix.b)
Error results: during DELAYED testing (vii.c)	Assess GROUP proficiency and identify types of errors on a delayed basis (viii.c)	-Assessment of RETENTION problems (ix.c)
Error results: for two or more criterion behaviors (vii.d)	Assess GROUP proficiency as a means of assessing adequacy of sequencing decisions (viii.d)	-Assessment of adequacy of SEQUENCING decisions (ix.d)

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D.	USE OF "DELAYED" TESTING	151-154
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A. ASSESSING PROFICIENCY

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How to use FORM J.2(2) for recording error patterns	114
Purposes in recording "by items," "by groups of items," and "by students"	115
Two methods for interpreting errors: by results on individual items and by patterns on groups of items	116

J.2.3

IDENTIFICATION **MATRIX**

PURPOSES IN COMPARING RESULTS ON TESTS ADMINISTERED "BEFORE" AND "AFTER" STUDENTS TAKE THE INSTRUCTIONAL PROGRAM

PURPOSES	ASSESSING THE EFFECTIVENESS OF THE INSTRUCTIONAL PROGRAM	IDENTIFYING WHICH STUDENT RESULTS TO USE AS A BASIS FOR PROGRAM REVISION
CRITERIA	*-Without "before" results to be used for baseline data, it is not possible to assess the adequacy of the instructional program in producing efficiency:* *··If, for example, proficiency were high to begin with, high proficiency on the after test would not be as meaningful as it would be if there were low proficiency to begin with* *-"Before" test results can be used to identify students with low entering proficiency and to determine what the program does for them*	*-Students who tested low "before" taking the program and who test low (i.e., make more errors) "after" taking the program can provide the sample of results which can be interpreted and used as a basis for program revision*

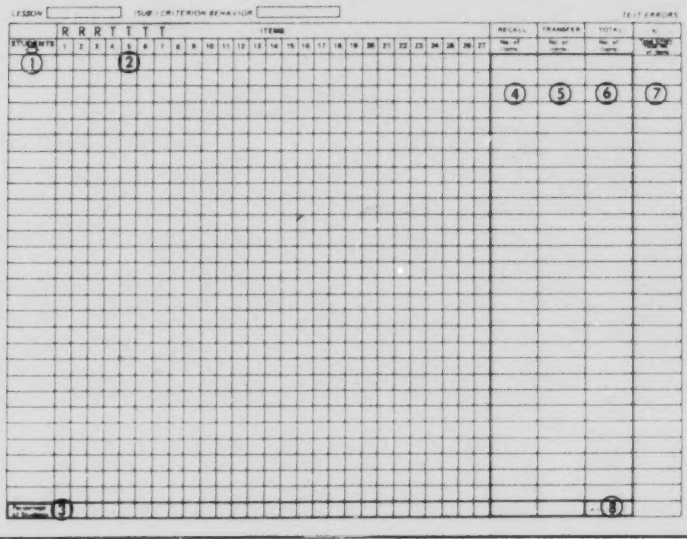
J.2.3
DECISION
MATRIX

HOW TO USE FORM J.2(2) TO RECORD ERRORS ON TESTS ADMINISTERED "BEFORE" AND "AFTER" STUDENTS TAKE THE INSTRUCTIONAL PROGRAM

TYPE OF ENTRIES	INDIVIDUAL entries	"TOTAL" entries
	1. *Use each row to record the errors each student makes on the test.* 2. *Use each column to record the item(s) on which error(s) is (are) made.* 8. *Use the summary box to record the number of students making predetermined percentage of errors:* *••20% or more is recommended*	3. *Use the bottom row to record the percentage of students making an error for each test item.* 4. *Use the "RECALL" column to record the total number of errors each student made on all RECALL items.** 5. *Use the "TRANSFER" column to record the total number of errors each student made on all TRANSFER items.** 6. *Use the "TOTAL" column to add the number of RECALL and TRANSFER errors for each student.* 7. *Use the % column to express for each student the percentage of errors he made on all items.*

*Individual items should be coded by an R (RECALL) or by a T (TRANSFER) (See example below)

FORM J.2(2)

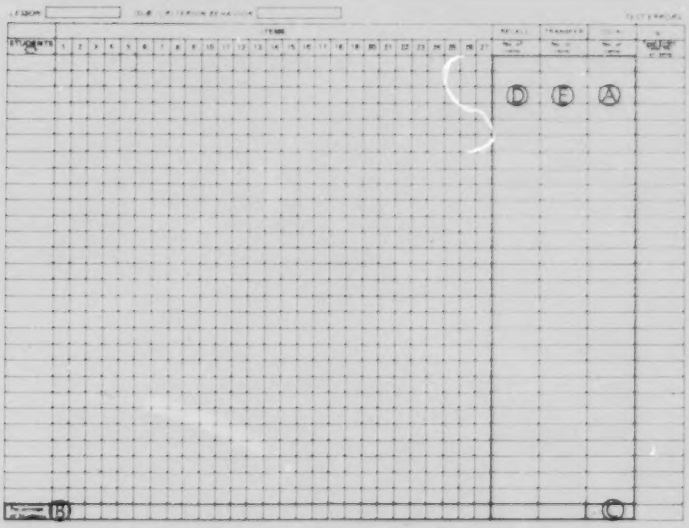


J.2.3

IDENTIFICATION **MATRIX**

PURPOSES IN RECORDING ERRORS:
BY ITEMS, BY GROUPS OF ITEMS, AND BY STUDENTS

METHODS OF TOTALING ERRORS	By INDIVIDUAL STUDENTS	By GROUPS OF STUDENTS	By GROUPS OF ITEMS
CRITERIA	A. *Summing errors for each student (in a row) permits:* *··The assessment of the degree of proficiency (or lack of it) he has attained on the basis of taking the instructional program* *··The identification of which students to select for further analysis of error patterns*	B. *Summing errors for each test item (in a column) permits a determination of what percentage of students failed that particular item (This may point to need for program revision, particularly if it is a RECALL item, i.e., something covered in the instructional program)* C. *The number of students exceeding a predetermined error rate identifies the degree of need of program revision results*	D. *Summing errors by RECALL items only and* E. *By TRANSFER items only permits an identification of how to program has failed:* *··On transfer only* *··On recall and transfer both*



J.2.3

IDENTIFICATION MATRIX

TWO METHODS FOR ANALYZING ERRORS AS A BASIS FOR DIAGNOSING PROBLEMS

METHODS	Analysis of group results on ••INDIVIDUAL items ••GROUPS of items	Analysis of results of individual students on ••MULTIPLE items
CRITERIA	-*Identification of individual test items failed by a predetermined percentage of students* -*Identification of specific types of items failed by a predetermined percentage of students:* ••*RECALL items* ••*TRANSFER items* -*Identification of total error scores*	-*Analysis of the pattern of errors made by individual students* ••*Does the same student make the same or different type of error on:* /*Multiple items* /*RECALL/TRANSFER items*
SEE PAGES	117-123	125-153

Form J.2(2)

LESSON [ ] (SUB-) CRITERION BEHAVIOR [ ]

TEST ERRORS

STUDENTS	ITEMS 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	RECALL No. of Items	TRANSFER No. of Items	TOTAL No. of Items	% Total Errors / Total No. of Items
Percentage of Students																													n =		

116a

Form J.2(2)

LESSON [ ] (SUB-) CRITERION BEHAVIOR [ ]

STUDENTS	ITEMS																											TEST ERRORS			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	RECALL No. of Items	TRANSFER No. of Items	TOTAL No. of Items	% Total Errors / Total No of Items

B. USE OF GROUP RESULTS TO ASSESS PROFICIENCY

	page
Three types of GROUP measures useful in assessing proficiency and in identifying the need for revision	118
How to interpret GROUP error scores on total test	119
How to interpret GROUP error scores on RECALL and TRANSFER items	120
How to deal with GROUP error scores on individual test items	121
Analyzing GROUP error scores on individual test items	122, 123

J.2.3

IDENTIFICATION MATRIX

THREE TYPES OF "GROUP" MEASURES USEFUL IN ASSESSING PROFICIENCY AND IN IDENTIFYING THE NEED FOR PROGRAM REVISION

TYPES OF "GROUP" MEASURES	Group error score on: ..TOTAL test	Group error score on: ..All RECALL items ..All TRANSFER items	Group error score on: ..INDIVIDUAL test items
CRITERIA	*Computation of a group error score involves:* *-Summing the number of errors for each student on all test items covering a sub-criterion behavior or a criterion behavior* *-Expressing (for each student) the number of errors he made as a percentage of the total number of errors possible (total number of test items)* *-Counting the total number of students exceeding a predetermined error percentage and expressing that number as a percentage of the total number of students taking the test*	*Computation of a group error score involves:* *-Summing the number of errors for each student on all RECALL items separately and on all TRANSFER items separately* *-Expressing for each student the number of RECALL (TRANSFER) errors he made as a percentage of the total number of RECALL (TRANSFER) errors possible* *-Counting the total number of students exceeding a predetermined error percentage and expressing that number as a percentage of the total number of students taking the test: two percentages are found, one for RECALL and one for TRANSFER*	*Computation of a group error score involves:* *-Summing the number of students for each test item* *-Expressing the sum (of students) as a percentage of students making errors on that item*
SEE PAGE	119	120	121
EXAMPLES	e.g., *-Student #1 - Made errors on 5 test items out of a total of 50 items, for an error rate of 10%* *-Student #2 - Made errors on 10 items, for an error rate of 10%* *-Student #n - Made X errors for an error rate of Y%* *-15 out of 50 students had an error rate of 20% or more* *-30% of the students exceeded an error rate of 20%*	e.g., *-Student #1 - Made no errors on the 20 RECALL items, for an error rate of 0%, and 5 errors on the 30 TRANSFER items, for an error rate of 17%* *-Student #n had an error rate on RECALL items of X% and on TRANSFER items of Y%* *-5 out of 50 students (or 10%) had a RECALL error rate of 20%* *-20 students out of 50 (or 40%) had a TRANSFER error rate of 20% or more*	e.g., *-On test item #1, 20 students out of 50 students, or 40% of the whole group, made errors*

J.2.3

DECISION MATRIX

DETERMINING HOW TO INTERPRET GROUP ERROR SCORES ON TOTAL TEST

CONDITIONS	A HIGH percentage of students score below a predetermined error rate on TOTAL test*	A HIGH percentage of students score above a predetermined error rate on TOTAL test*
ACTION TO TAKE	-*Consider the program in reasonably good shape* -*Review the RECALL and TRANSFER scores to determine whether the errors which do occur divide up between the two types of items:* ••*Evenly, OR* ••*Unevenly* *(See page 120 for next steps to take)* -*Review the error rates for individual test items to determine if there are unusually high error rates for particular items (See page 121)*	-*Definitely consider the program in need of revision* -*Review the RECALL and TRANSFER scores to determine the extent of difference between the two types (as a basis for interpreting possible program weaknesses) (See page 120)* -*Review the error rates for individual test items to determine if there are unusually high error rates for particular items (See page 121)*
EXAMPLES	e.g., -*In a tryout sample of 40 students, 90% of the students had error rates of 19% or less* -*Further review of results would be conducted to identify specific types of learning failure which could serve as the basis for modest program revision*	e.g., -*In a tryout sample of 40 students, 40% of the students had error rates of 20% or more* -*Detailed review of group results and of results for individual students (on multiple test items) appear in order as a means of identifying the learning failures which have occurred*

*Which predetermined error rate is selected is arbitrary; a 20 percent rate is a convenient and often used rate.

J.2.3
DECISION
MATRIX

DETERMINING HOW TO INTERPRET GROUP ERROR SCORES ON RECALL AND ON TRANSFER TEST ITEMS

CONDITIONS	Error rates by types of items: RECALL: Low TRANSFER: Low	Error rates by types of items: RECALL: High TRANSFER: High	Error rates by types of items: RECALL: Low TRANSFER: High
ACTION TO TAKE	*The group error rate for all test items is low, and further analysis reveals an even distribution of low error rates for RECALL and for TRANSFER items:* *-No diagnostic clues are provided by these results* *-It may still be useful to look at individual test items to determine whether there are items on which unusually high error rates occur (as a basis for search for specific sections of the program to account for this result)*	*An equally high RECALL and TRANSFER rate is not diagnostic of specific types of problems:* *-Consider the entire program in need of revision* *-Do further analyses:* *··Review group results on individual items (See next page)* *··Review individual results on multiple items (See next section on page 125)*	*RECALL rates are low and TRANSFER rates are high:* *-Consider "generalization" as the possible learning failure,* *AND* *-Do further analyses:* *··Review group results on individual items (See next page)* *··Review individual results on multiple items (See next section on page 125)*
EXAMPLES	e.g., RECALL Results *10% of the student sample made less than 20% errors on recall items* TRANSFER Results *15% of the student sample made less than 20% errors on transfer items*	e.g., RECALL Results *25% of the student sample made more than 20% errors on recall items* TRANSFER Results *40% of the student sample made more than 20% errors on transfer items*	e.g., RECALL Results *5% of the student sample made less than 20% errors on recall items* TRANSFER Results *35% of the student sample made more than 20% errors on transfer items*

J.2.3
DECISION
MATRIX

DETERMINING HOW TO INTERPRET GROUP ERROR SCORES ON INDIVIDUAL TEST ITEMS

CONDITIONS	LOW group error rate on individual test items	HIGH group error rate on individual test items
ACTION TO TAKE	-*Do not do any further analysis*	-*Group error rates per se on a single test item are not diagnostic* -*When revising the program, review the portion of the program relating to a specific test item for possible deficiencies* -*Obtain additional information about the types of wrong answers produced as a means of gaining diagnostic information (See next page)*
EXAMPLES	e.g., -*On test item #13, 9% of the student sample made errors*	e.g., -*On test item #13, 34% of the student sample made errors* -*Analyze the frequency of particular types of errors made*

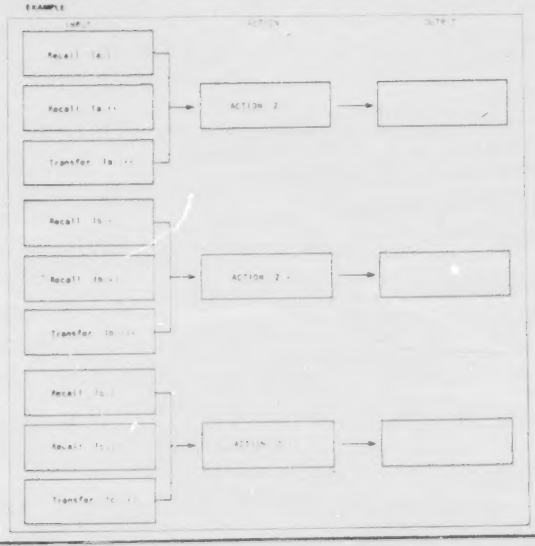
J.2.3
IDENTIFICATION
MATRIX

TYPES OF ERRORS WHICH CAN BE IDENTIFIED
WHEN ANALYZING GROUP RESULTS ON INDIVIDUAL ITEMS

TYPE OF ERROR	OMISSION of a correct ACTION	WHICH incorrect ACTION was taken
	-*Either on a multiple choice item or on a production item, students may omit an answer* -*FORM J.2(1) may be used to indicate how many students omitted an answer for a particular test item* (Time students for test item #1 below)	-*Either on a multiple choice item or on a production item, students may give an incorrect answer.* ••*May take an ACTION which is associated with a class of INPUTS other than the one used in the test item* -*FORM J.2(1) may be used to identify which wrong ACTION (out of the two or more--for the two or more classes of INPUTS involved in the problem)* ••*Rows b, c, d, e can be used to designate wrong ACTIONS i, ii, iii, etc.* (In the example below, 32 students took ACTION i, which was wrong, and 13 students took ACTION ii, which was wrong)

EXAMPLE

TASK ANALYSIS DIAGRAM



FORM J.2(1)

Form J.2(1)

LESSON _____ (SUB-)

ITEM #'S / Options Endorsed	1	2	3	4	5
a omissions	5				
b i	32				
c ii	13				
d *iii					
e					

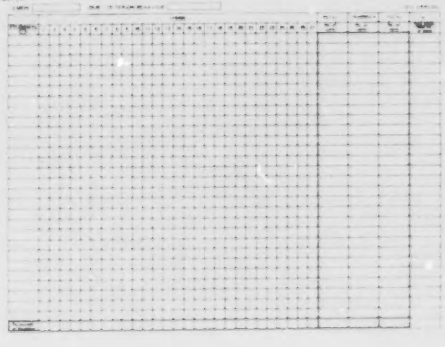
*This is correct ACTION (because test item used a "1c" INPUT)

J.2.3
DECISION
MATRIX

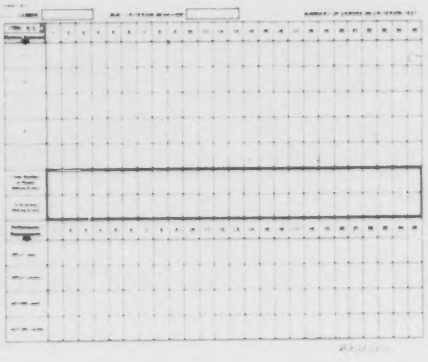
DETERMINING HOW TO ANALYZE AND INTERPRET GROUP ERROR SCORES ON INDIVIDUAL ITEMS

GOAL	To RECORD GROUP error results for individual test items	To INTERPRET GROUP error results for individual test items
ACTION TO TAKE	-*For test items (identified on FORM J.2(2)) on which there are high group error rates, select the test papers (or answer sheets) of all those students who made errors on a particular item* -*On FORM J.2(1), code rows a, b, c, d, and e for types of errors:* ··*Omission* ··*Wrong ACTION: i, ii, iii, iv, etc.* -*Record on FORM J.2(1) the frequency with which each type of error is made*	-*Interpretation based on individual items is undependable* *HOWEVER* -*Identify which type of error predominates:* ··*An omission* ··*Which incorrect ACTION is most frequently taken* -*This can form the basis for analyzing program materials to account for this particular type of error pattern (See next page)*

FORM J.2(2)



FORM J.2(1)



J.2.3

DECISION MATRIX

DETERMINING HOW TO INTERPRET GROUP RESULTS ON INDIVIDUAL TEST ITEMS

CONDITIONS	OMISSION of response	ROUGHLY EQUAL DISTRIBUTION of types of wrong ACTIONS	UNEQUAL DISTRIBUTIONS of types of wrong ACTIONS (one type of incorrect ACTION predominates)
ACTION TO TAKE	*INTERPRET as:* *-A failure to acquire relevant skills (either discriminations, generalizations, or associations)* *-Which skill is not acquired is indeterminate*	*INTERPRET as:* *-An unsystematic learning failure (of relevant skills)* *-Which skill is not acquired is indeterminate*	*INTERPRET as:* *-A systematic learning failure (of relevant skills)* *-One or more of the relevant skills has been learned incorrectly*
EXAMPLE	The test item involves classifying an example of a lever as a 1st, 2nd, or 3rd class lever. The example used is a 1st class lever.		
	e.g., *-Of those making errors, approximately 75% omitted making any response* *-No learning has occurred*	e.g., *-Of those making errors on this item, 33% omitted answering, 33% endorsed 2nd class, and 33% endorsed 3rd class* *-The failure is unsystematic*	e.g., *-Of those making errors on this item, 80% endorsed 2nd class lever* *-The failure is systematic*

NOTE:

As an introduction to procedures to follow in interpreting learner difficulties which result in errors on tests, REVIEW PAGES 73-90 IN SECTION "F" OF THE HANDBOOK.

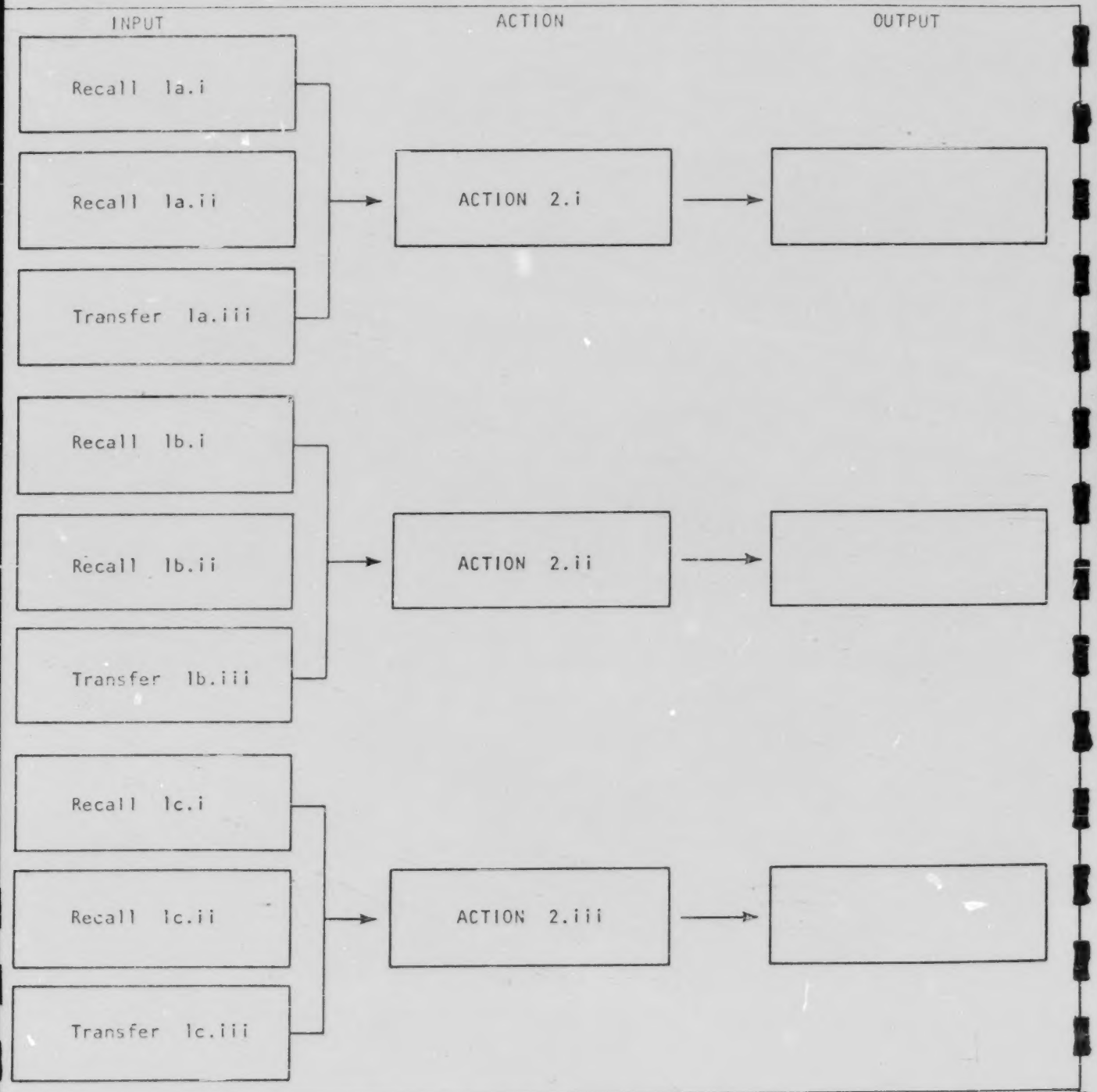
INTERPRETING ERROR PATTERNS FOR INDIVIDUAL STUDENTS ON MULTIPLE TEST ITEMS *

	page
Three ways multiple test items make interpretation of error patterns possible	128, 129
Forms to use in analyzing error patterns on multiple test items	130, 131
Procedures for filling out, scoring, and analyzing FORMS J.2(1) and J.2(3) for individual students	132, 133
Identifying error patterns	134, 135
FOLDOUT with subject matter examples	
Selecting students whose test scores should be analyzed for error patterns	136
Guidelines for estimating confidence with which interpretations can be made	137
Illustrative error patterns and interpretations	138-147
Recommended procedures for identifying error patterns	148

* *The procedures recommended in this section represent an innovative and, as of March 1973, an unvalidated approach for diagnosing learning failures. Moreover, because the procedures are highly complicated, the reader is advised to: review this section, attempt the associated WORKBOOK exercises, and, should he experience difficulties, shrug them off.*

FOLD OUT THIS PAGE
AND REFER TO IT WHILE
YOU READ PAGES 128-140

EXAMPLE


INPUT
ACTION
OUTPUT
Recall 1a.i
Recall 1a.ii
Transfer 1a.iii
ACTION 2.i
Recall 1b.i
Recall 1b.ii
Transfer 1b.iii
ACTION 2.ii
Recall 1c.i
Recall 1c.ii
Transfer 1c.iii
ACTION 2.iii

J.2.3

MATRIX

THREE WAYS MULTIPLE TEST ITEMS ASSIST IN DIAGNOSING THE TYPE OF LEARNING FAILURE WHICH HAS RESULTED IN TEST ERRORS

ANALYSES MULTIPLE ITEMS ALLOW	1 Sampling of INPUT classes	2 Assessing the CONSISTENCY of errors	3 Comparison of RECALL and TRANSFER items
CRITERIA	*Multiple test items permit to be represented in the test:* *-Two or more of the INPUT classes which have to be discriminated* *and/or* *-Two or more members belonging to the same INPUT class which require generalization*	*Use of multiple test items allows the assessment of the consistency with which errors are made:* *-Is the same or a different wrong ACTION taken to two or more INPUTS belonging to the same class?* *-Is the same or a different wrong action taken to INPUTS belonging to all the INPUT classes or to some of the INPUT classes?*	*Use of multiple test items, some RECALL items and some TRANSFER, permits a comparison of:* *-Errors occurring in one but not the other type of test item* *-Errors occurring in both types of test items*
EXAMPLES (See illustration on opposite page for notation)	Multiple test items permit the sampling of: -The three classes of INPUTS: (1a, 1b, and 1c): ··Three test items can provide one example from each class -The multiple members within each class: (i, ii, and iii): ··Nine test items can provide one example for each member represented in the diagram	Multiple test items permit the assessment of whether errors are consistent or inconsistent: -Is ACTION (2.ii) incorrectly taken: ··For just (1a.i), or ··For (1a.ii) and (1a.iii) as well -Is ACTION (2.ii) incorrectly taken: ··For just class 1a), or ··For both class (1a) and (1c)	Multiple test items permit a comparison of RECALL and TRANSFER items: -Is ACTION (2.iii) incorrectly taken: ··For just TRANSFER (1a,iii), or ··For both RECALL (1a.i) and TRANSFER (1a.iii)

J.2.3
IDENTIFICATION
MATRIX

FORMS TO USE IN ANALYZING
PATTERNS OF ERRORS ON MULTIPLE ITEMS
(ON THIS AND ON OPPOSITE PAGE)

FORMS	FORM J.2(2)	FORM J.2(1)
CRITERIA	-*From FORM J.2(2) students with high error scores are selected to comprise the sample for pattern analysis*	-*Each student has a FORM J.2(1) filled out* -*His responses to each test item are recorded on the form* -*Rows a-e are used to record the following error information:** *a: ACTION for class 1a taken* *b: ACTION for class 1b taken* *c: ACTION for class 1c taken* *d: ACTION for class 1d taken* *e Omissions* -*Templates are used to identify types of errors made (See page 132 for procedures):* *••For each INPUT class* *••For RECALL and TRANSFER*

*Record which wrong ACTION was taken; e.g., if the INPUT presented in the test item was a class 1b INPUT and student produced the ACTION which is supposed to be associated with class 1c, an X would be put in row c; an X in row d would mean that the ACTION for class 1d was produced.

Form J (2)

LESSON [ ] SUB-CRITERION BEHAVIOR [ ]

TEST ERRORS

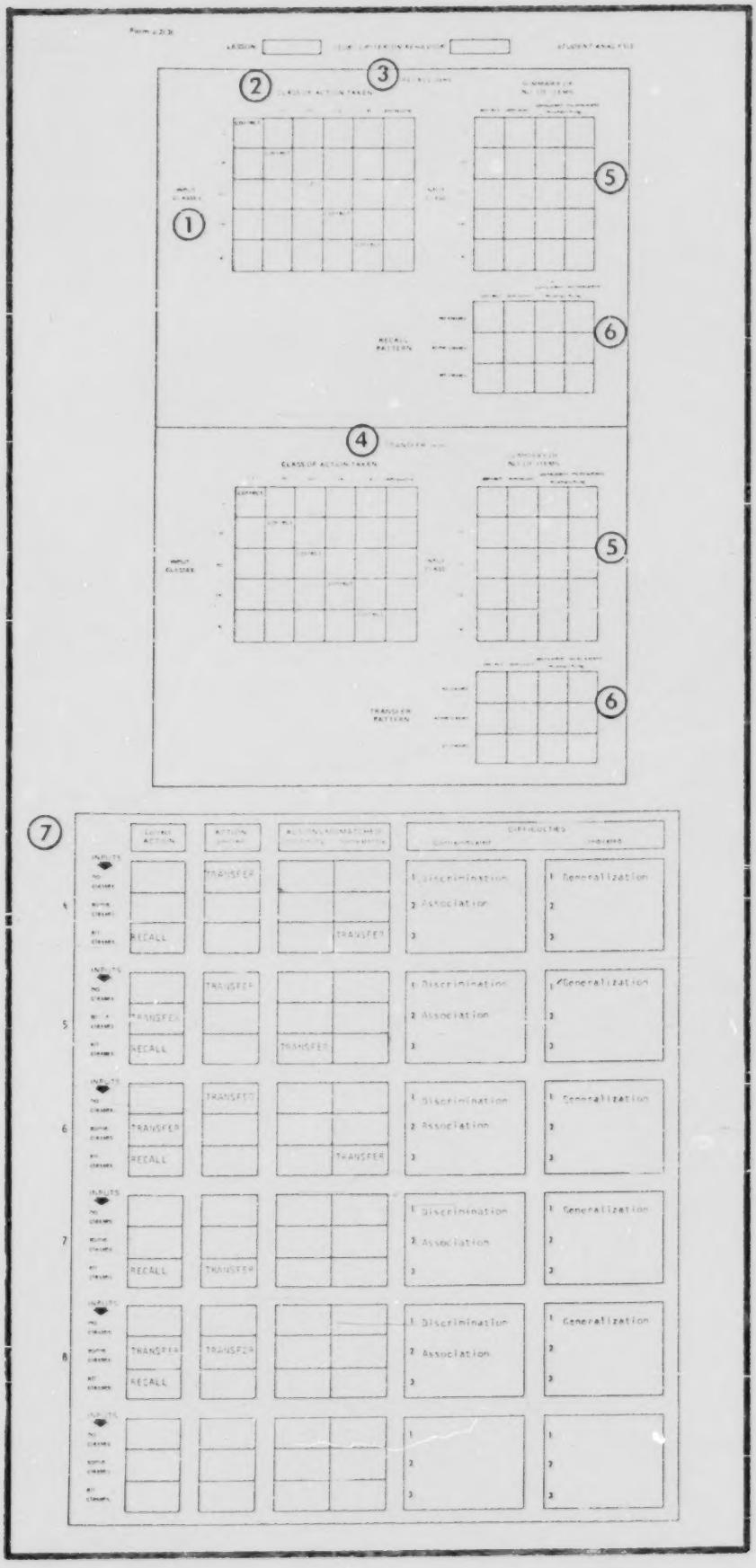
STUDENTS	ITEMS 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	TRANSFER No. of Items	TOTAL No. of Items	% Total Errors / Total No. of Items

IDENTIFICATION MATRIX

FORMS TO USE IN ANALYZING PATTERNS OF ERRORS ON MULTIPLE ITEMS (ON THIS AND ON OPPOSITE PAGE)

FORMS	FORM J.2(3)	TABLES
CRITERIA	-*For each student the types of wrong ACTIONS taken which were identified on FORM J.2(1) are recorded on FORM J.2(3), separately:* (1) ··*By each INPUT class* (2) ··*By each ACTION class taken* (3) ··*By RECALL items* (4) ··*By TRANSFER items* -*The types of errors are summarized and categorized* (5) -*An error pattern is identified for the student* (6) *(See page 133 for procedures)*	-*The student's error pattern* (6) *is compared with patterns in the tables provided in this section* (7) *and the type of learning failure identified* *(See page 133 for procedures)*

FORM J.2(3)



TABLE

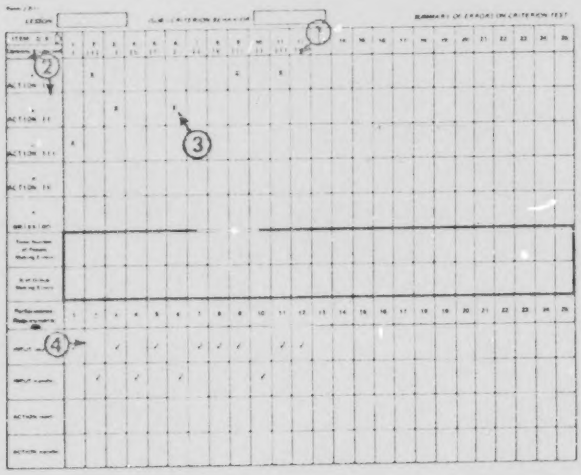
Sub-STEP J.2.3

PROCEDURES FOR COMPLETING FORM J.2(1) FOR EACH STUDENT

1. Identify the INPUT class sampled in each test item with a Roman number: Class I, II, III, IV, etc.
2. Use rows for ACTION classes corresponding to INPUT classes (I-IV, etc.), plus a row for omissions
3. Record (from original test paper) the wrong ACTION taken (if any) or omission (No entry in a column means that item was correct)
4. Identify by checking the appropriate category whether a test item requires INPUT RECALL or INPUT TRANSFER

(Proceed below to procedures for preparing a template for scoring types of errors)

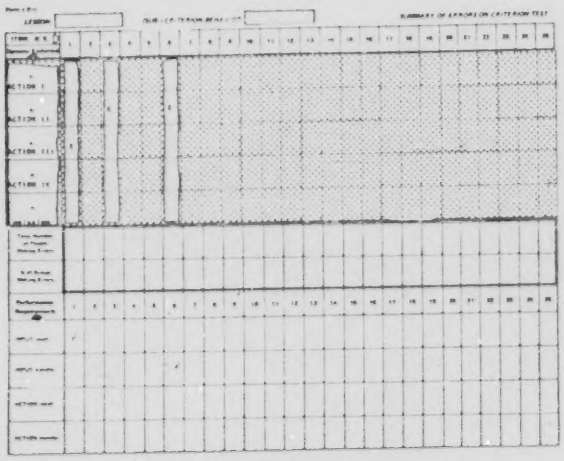
FORM J.2(1) EXAMPLE



PROCEDURES FOR PREPARING A SCORING TEMPLATE

1. Create a template for each of the INPUT classes involved in the criterion or sub-criterion behavior:
   - ..The template should expose all the test items and the possible answers for each class of INPUTS
   - ..In the example below all the answers to items for INPUT Class I are exposed
   - ..On one item #1 a Class III action was taken; and on #6, a Class II action was taken
2. For each INPUT class, add up separately for RECALL items and for TRANSFER items:
   - -The number of correct answers
   - -The number of incorrect ACTIONS taken by type (i.e., I, II, III, etc.)
   - -The number of omissions
   - ..In the example below these results are shown:
     - /For RECALL items (no correct answers, one II wrong ACTION, one III wrong ACTION)
     - /For TRANSFER items (no correct answers, one II wrong ACTION, no III wrong ACTION)

FORM J.2(1) AS A TEMPLATE (EXAMPLE)



PROCEDURES FOR RECORDING TEMPLATE RESULTS ON FORM J.2(3)

(1.) Record the sums obtained from the template analysis on FORM J.2(3):

- ··For each INPUT class
- ··Separately by RECALL and TRANSFER items

(2.) Summarize the results of the analyses for each INPUT class by the following categories:

- ··Number correct
- ··Number omitted
- ··Number of consistent mismatches of INPUTS and ACTIONS
- ··Number of inconsistent mismatches of INPUTS and ACTIONS

(3.) Obtain an error pattern by adding up the number of classes resulting in each category

··SEE NEXT PAGE FOR PROCEDURES

FORM J.2(3) EXAMPLE (RECALL portion only)

Template analysis is recorded here →

Read record as follows:

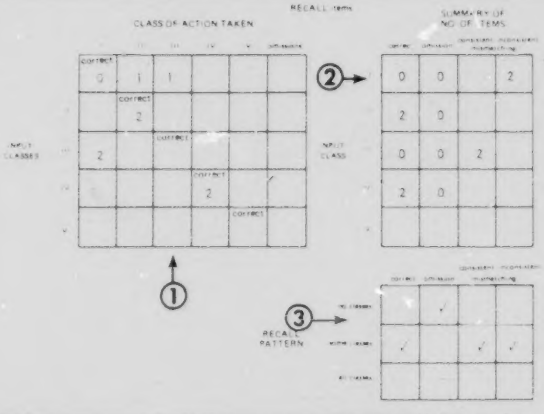
-For INPUT Class I:

··Zero correct ACTIONS

··One Class II ACTION

··One Class III ACTION

-Etc.



Record in (1) is summarized and categorized here in (2)

-For INPUT Class I:

··Zero correct ACTIONS

··Zero omissions

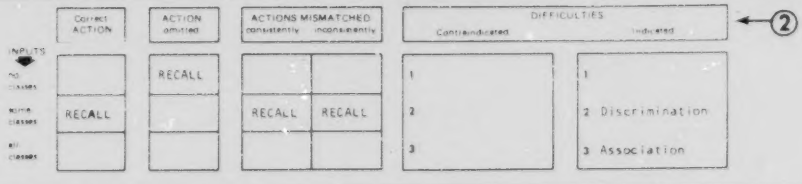
··Two (inconsistent) mismatchings

A portion is filled out in (3) by adding up results in (2); e.g., no INPUT classes resulted in omissions

PROCEDURES FOR COMPARING OBTAINED PATTERN WITH PATTERNS IN TABLES

1. Using both the RECALL pattern and the TRANSFER pattern you have obtained (the example has only RECALL), find the table in this section of the BOOK with which it corresponds.
2. If there is a table to match the one you have obtained, read off the diagnosis.
3. Repeat all these procedures for all students whose results are to be analyzed in detail.

(1)→ TABLE EXAMPLE

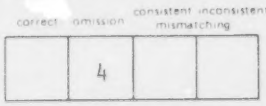
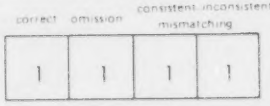
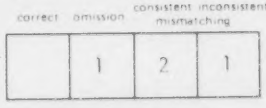


J.2.3
DECISION
MATRIX

DETERMINING HOW TO DEVELOP A RECALL OR TRANSFER PATTERN BASED ON THE SUMMARY OF NUMBER OF ITEMS FALLING INTO EACH CATEGORY (BY CLASS OF INPUTS)

CONDITIONS	ALL items for a given INPUT class fall into ONE cell: ··All correct, OR ··All omitted, OR ··All consistently mismatched, OR ··All inconsistently mismatched	Items for a given INPUT class are approximately <u>equally</u> divided across cells	A MAJORITY (or near majority) of items for a given INPUT class fall into ONE cell
ACTION TO TAKE	*-Categorize that <u>class</u> in keeping with the 100% endorsement*	*-Do not categorize that class* *-That automatically makes it <u>impossible</u> for the subsequent totaling of the number of classes falling into any category from being "all classes"* *-The RECALL pattern or the TRANSFER pattern would, therefore, involve either "no" classes or "some" classes*	*-Categorize that <u>class</u> in keeping with the <u>majority</u> endorsement* *SEE NOTE BELOW*

*The larger the number of items there are covering an INPUT class AND the more of them falling into a given cell, the more dependable the finding and the more dependable the diagnosis based on it.

EXAMPLES	SUMMARY OF NO. OF ITEMS	SUMMARY OF NO. OF ITEMS	SUMMARY OF NO. OF ITEMS
			
	-On all four test items covering Input Class #1, the student omitted an answer *-INPUT Class #1 should be categorized as "omitted"*	*-INPUT Class #1 would not be categorized*	*-A near majority of items falls into the "consistent mismatching" category* *-Categorize INPUT Class #11 as "consistently mismatched"*

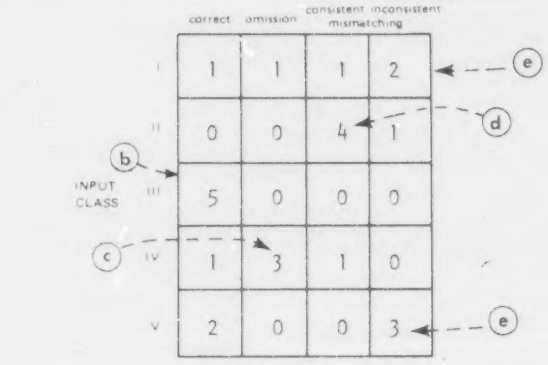
J.2.3

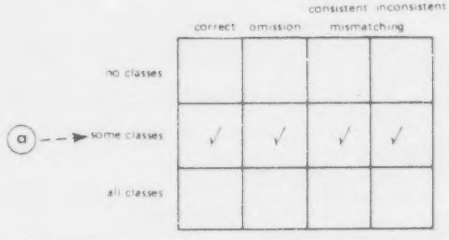
EXAMPLES ILLUSTRATING HOW TO FILL IN A RECALL OR TRANSFER PATTERN

EXAMPLES

#1

SUMMARY OF NO. OF ITEMS





FILL IN ERROR PATTERN HERE

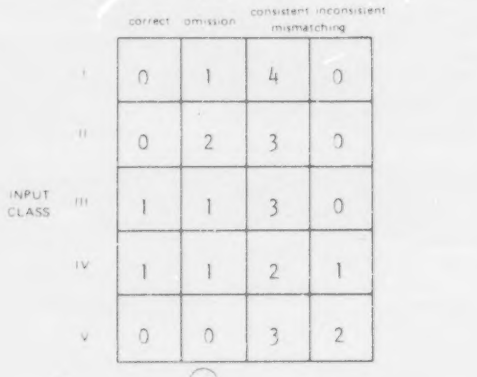
DISCUSSION

-Each of the four "categories" is applicable only to "some" (a) INPUT classes

- "Correct" is applicable only to Class III (b)
- "Omission" is applicable only to Class IV (c)
- "Consistent" is applicable only to Class II (d)
- "Inconsistent" is applicable to Classes I and V (e)

#2

SUMMARY OF NO. OF ITEMS



DISCUSSION

-The category "correct" is applicable to no classes (f)

-The category "omission" is applicable to no classes (g)

-The category "inconsistent" is applicable to no classes (h)

-The category "consistent" is applicable to all classes (i)

J.2.3

DECISION MATRIX

HOW TO SELECT STUDENTS WHOSE PERFORMANCE ON MULTIPLE TEST ITEMS SHOULD BE ANALYZED

STUDENT PERFORMANCE ON TOTAL TEST	Students with LOW error rates on TOTAL test: i.e., less than a 20% error rate	Students with HIGH error rates on TOTAL test: i.e., more than a 20% error rate
ACTION TO TAKE	*-Do not include the results of these students in the detailed analysis of error patterns*	*-Consider the results of these students for inclusion in the detailed analysis of error patterns* *-Select from among these students those with error rates in the range of 30%-60% (if available)* *-Exclude students with error rates of 70% or higher* *-Select a sample of approximately ten to twenty students for this analysis*
RATIONALE	Low frequency of errors makes it difficult to detect patterns of errors	-A small sample of students is recommended (i.e., n = 10-20) because this type of analysis is time consuming -Error rates in excess of 60%-70% are probably indicative of no learning having occurred rather than of specific failures to be diagnosed

J.2.3
DECISION
MATRIX

	VARIABLES TO CONSIDER IN ESTIMATING THE CONFIDENCE WITH WHICH INTERPRETATIONS CAN BE MADE	
CONDITIONS	-The more test items there are reflecting the same error pattern AND -The more students there are exhibiting the same error pattern	-The fewer test items there are reflecting the same error pattern AND -The fewer students there are exhibiting the same error pattern
ACTION TO TAKE	*INTERPRET* *-The more test items there are reflecting the same error pattern, the lower the probability that the results were obtained by chance* *-In combination with the above finding, the higher the percentage of students exhibiting the same error pattern, the more dependable the interpretation* *-The key variable, however, is the number of test items*	*INTERPRET* *-The fewer test items there are reflecting the same error pattern the higher the probability that the results were obtained by chance* *-In combination with the above finding, the lower the percentage of students exhibiting the same error pattern, the less dependable the interpretation*
EXAMPLES	-There are twelve test items, each item having a different example of a lever (four examples for each of the three classes of levers) -All four items from one of the classes are given the same wrong classification -The probability of this occurring by chance is relatively low -Interpretation is easier to make	-There are three test items, each item having a different example of a lever (one example for each of the three classes of levers) -One item from a class is given a wrong classification -The probability of this occurring by chance is relatively high -Interpretation is harder to make

AN EXPLANATION OF WHAT THE DIAGNOSTIC TABLE ENTRIES SIGNIFY

Each of the numbered statements below refers to a comparably numbered section of the illustrative diagnostic table below or to the task analysis table on the opposite page.

1. Rows in the table indicate how many classes were treated in particular ways by the student: all the INPUT classes, some of them, or all of them. For the example on the opposite page, that means, how were each of the three classes treated by the student. All means that three classes were treated in a particular way; some means that one or two were treated in a particular way; and no means that none of the classes were treated in a particular way.

2. Columns identify the ways in which INPUT classes were treated:

   ··Correct ACTIONS could have been taken

   ··ACTIONS could have been omitted

   ··INPUTS and ACTIONS could have been mismatched:

   /Consistently (i.e., multiple items from the same INPUT class led to the same wrong ACTION, belonging to another class)

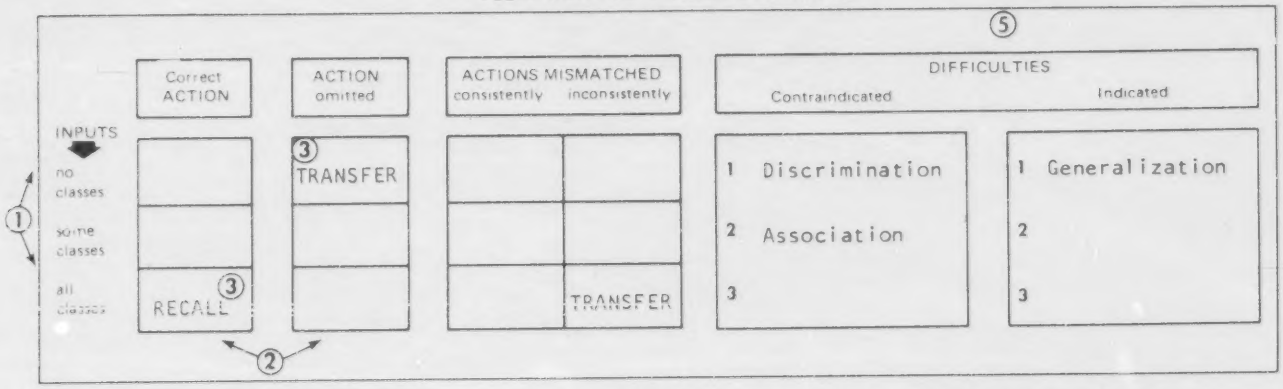
   /Inconsistently (i.e., multiple items from the same INPUT class led to varied wrong ACTIONS)

3. The different pattern applying to RECALL items and to TRANSFER items are indicated by entried labeled RECALL or TRANSFER

4. Multiple entries for either RECALL or for TRANSFER items are possible indicating that classes can be treated in a variety of ways (correct, incorrect, and with omission)

5. Diagnoses appear in the last two columns.

ILLUSTRATIVE DIAGNOSTIC TABLE*



*The illustrative table should be read as follows: on RECALL items all INPUT classes were treated correctly (i.e., the correct ACTIONS were produced); on TRANSFER items: no INPUT classes resulted in omission of an answer, and all INPUT classes resulted in inconsistent mismatching of INPUTS and ACTIONS.

INTERPRETATION: The most likely difficulty indicated is "generalization." In descending order of probability, the difficulties contraindicated are "discrimination" and "association."

FOLD BACK PAGE 127

TABLES

The next several pages present diagnostic tables interpreting error patterns which are more easily interpreted than other possible patterns. Whenever the patterns you encounter in your work are not illustrated here and it is unclear what learning difficulties produced test errors, you may have to resort to the administration of diagnostic tests and interview probes (See Sub-STEP J.2.4).

FOLD OUT THIS PAGE FOR SUBJECT MATTER EXAMPLES WHICH WILL BE USED TO ILLUSTRATE ERROR PATTERNS

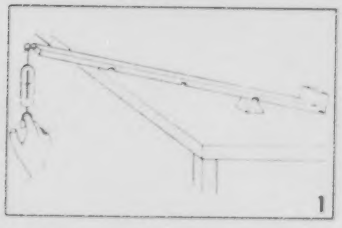
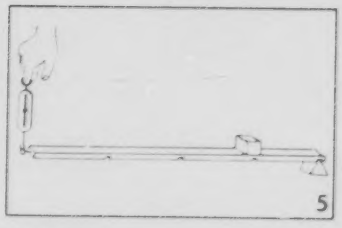
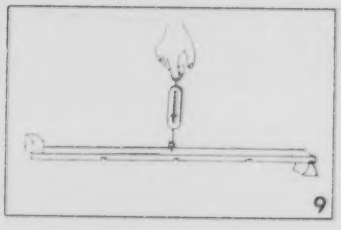
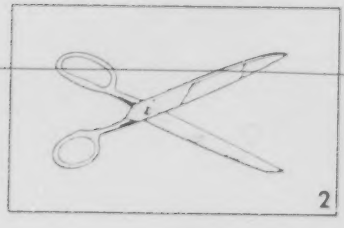
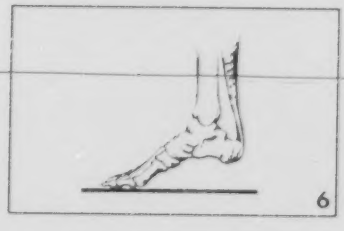
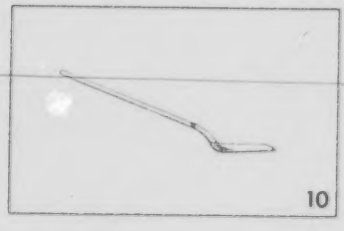
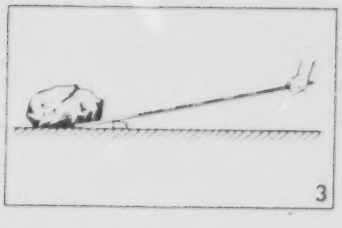
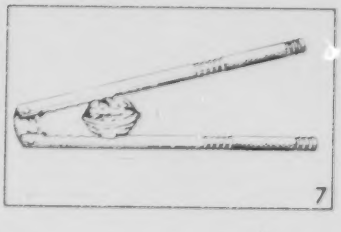
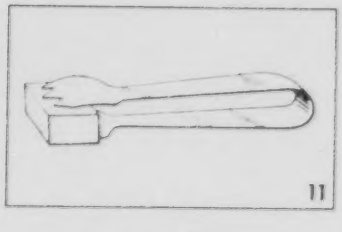
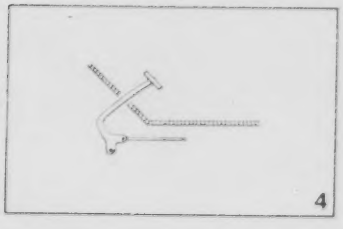
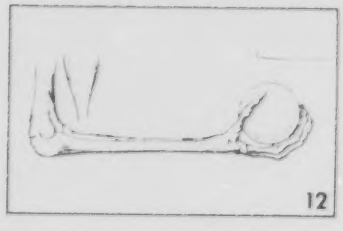
ILLUSTRATIVE SUBJECT MATTER AND TEST ITEMS

CRITERION BEHAVIOR: To classify examples of levers belonging to each of the three classes of levers.

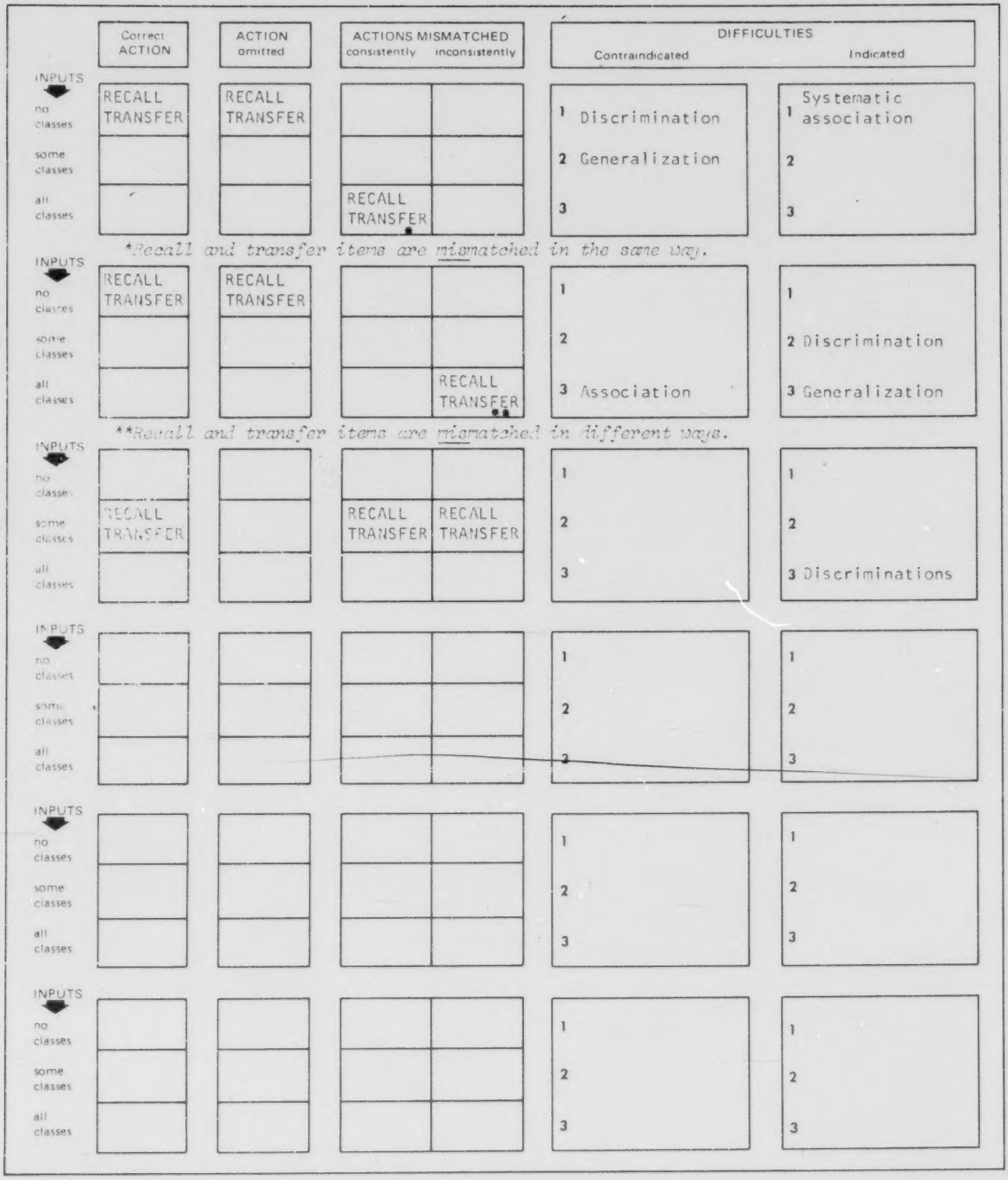
CRITERION TEST: Twelve test items comprise the criterion test:

- Four items apiece test for each class of levers (INPUTS)
- Of the four items for each class:
  - Two are RECALL items (containing examples used in instruction)
  - Two are TRANSFER items (containing examples not used in instruction)

EXAMPLES USED IN EACH OF TWELVE TEST ITEMS:

	Class I	Class II	Class III
RECALL	 1	 5	 9
RECALL	 2	 6	 10
TRANSFER	 3	 7	 11
TRANSFER	 4	8	 12

SOME DIAGNOSTIC TABLES


Correct ACTION
ACTION omitted
ACTIONS MISMATCHED
consistently
inconsistently
DIFFICULTIES
Contraindicated
Indicated
INPUTS
no classes
some classes
all classes
1
RECALL TRANSFER
RECALL TRANSFER
RECALL TRANSFER
1 Discrimination
2 Generalization
3
1 Systematic association
2
3
*Recall and transfer items are mismatched in the same way.
2
RECALL TRANSFER
RECALL TRANSFER
RECALL TRANSFER
1
2
3 Association
1
2 Discrimination
3 Generalization
**Recall and transfer items are mismatched in different ways.
3
RECALL TRANSFER
RECALL TRANSFER
RECALL TRANSFER
1
2
3
1
2
3 Discriminations

J.2.3

EXAMPLES ILLUSTRATING PATTERNS ON OPPOSITE PAGE*

EXAMPLES

	RESULTS	INTERPRETATION
PATTERN #1	a. All classes of levers have been mismatched, for both RECALL and TRANSFER items b. The mismatching was consistent: (1) Each of the classes of levers (I, II, III) led to a different (wrong) ACTION (labeling) PLUS (2) Each of the examples within a class led to the same (wrong) ACTION (labeling): ••1, 2, 3, 4 were classified as III ••5, 6, 7, 8 were classified as I ••9, 10, 11, 12 were classified as II	*b. (1) Since each of the quartets of items represents a different class and all quartets were classified in different (wrong) ways, discrimination is NOT the problem* *b. (2) Since members of each quartet represent the same class and each of the members is labeled the same (wrong) way, generalization is NOT the problem* *b. The problem is one of systematically wrong associations*
PATTERN #2	a. All classes of levers have been mismatched, for both RECALL and TRANSFER items b. The mismatching was inconsistent: (1) Some of the classes were treated the same way other classes were: ••I and II were treated the same way; OR ••I and III were treated the same way; OR ••II and III were treated the same way (2) SOME of the examples within a class were treated with a different (wrong) response: ••1 and 3 were classified III ••2 and 4 were classified II	*b. (1) Classes which should have been treated differently were treated alike* *(2) Examples within classes which should have been treated alike were treated differently* *b. The problem is probably one of discrimination and generalization*
PATTERN #3	a. Some classes were treated correctly; some incorrectly b. Incorrect treatment was consistent for some classes and inconsistent for others	*b. Problem may be that of discrimination*

*Numbers used in the example refer to the test items on foldout page 140

	INPUTS	Correct ACTION	ACTION omitted	ACTIONS MISMATCHED consistently	ACTIONS MISMATCHED inconsistently	DIFFICULTIES Contraindicated	DIFFICULTIES Indicated
4	no classes		TRANSFER			1 Discrimination	1 Generalization
	some classes					2 Association	2
	all classes	RECALL			TRANSFER	3	3
5	no classes		TRANSFER			1 Discrimination	1 Generalization
	some classes	TRANSFER				2 Association	2
	all classes	RECALL		TRANSFER		3	3
6	no classes		TRANSFER			1 Discrimination	1 Generalization
	some classes	TRANSFER				2 Association	2
	all classes	RECALL			TRANSFER	3	3
7	no classes					1 Discrimination	1 Generalization
	some classes					2 Association	2
	all classes	RECALL	TRANSFER			3	3
8	no classes					1 Discrimination	1 Generalization
	some classes	TRANSFER	TRANSFER			2 Association	2
	all classes	RECALL				3	3
	no classes					1	1
	some classes					2	2
	all classes					3	3

J.2.3 EXAMPLES ILLUSTRATING PATTERNS ON OPPOSITE PAGE*

EXAMPLES

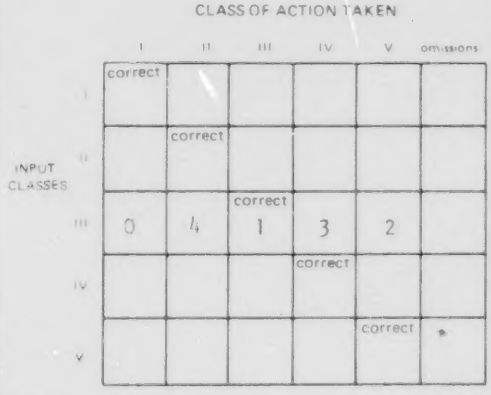
	RESULTS	INTERPRETATION
PATTERN #4	a. On RECALL items, all classes and members within classes have been correctly treated b. Mismatching of INPUTS and ACTIONS occurs for TRANSFER items only b.1 Consistent b.2 Inconsistent c. In some cases TRANSFER items are correct (for some classes) or are omitted (for some classes)	*a. Since all RECALL items are correct, correct discriminations and associations have occurred* *b. Only TRANSFER items are incorrect--suggesting that generalization to unencountered examples has failed*

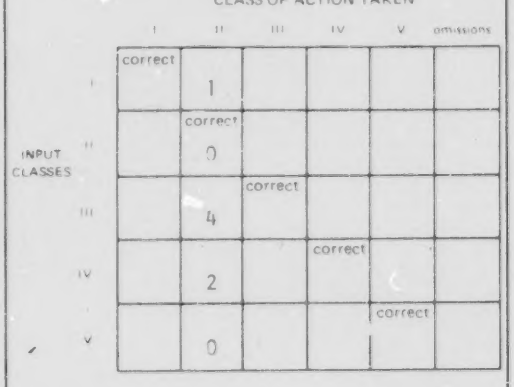
J.2.3
DECISION
MATRIX

DETERMINING HOW TO USE RAW DATA OF PATTERN ANALYSIS TO GAIN FURTHER DIAGNOSTIC INFORMATION

TYPE OF INFORMATION AVAILABLE	Data in matrix on FORM J.2(3) regarding INPUT classes	Data in matrix on FORM J.2(3) regarding ACTION classes
ACTION TO TAKE	*For <u>each</u> student in the <u>diagnostic</u> sample:* *-Observe for <u>each</u> INPUT class <u>where</u> the errors pile up; i.e., in ACTION Class I, II, III, IV, or V, or in an omission* *-Observe whether for other INPUT classes the pile up is:* *••The same* *••Different* *-Use this as raw data for identifying the confusions which exist* *COMPARE THE RESULTS WITH THOSE OF OTHER STUDENTS IN THE DIAGNOSTIC SAMPLE*	*For <u>each</u> student in the <u>diagnostic</u> sample:* *-Observe for <u>each</u> ACTION class where the errors pile up; i.e., in INPUT Class I, II, III, IV, or V, or in an omission* *-Observe whether for other ACTION classes the pile up is:* *••The same* *••Different*

EXAMPLES	Look for the distribution of errors across a <u>row</u>*	Look for the distribution of errors down a <u>column</u>*





*For illustrative purposes, only <u>one</u> has been filled in

J.2.3
IDENTIFICATION
MATRIX

	TWO VARIABLES USEFUL FOR IDENTIFYING DIFFICULTIES	
VARIABLES	EVENNESS of distribution of errors ··For INPUTS (across ACTIONS) ··For ACTIONS (across INPUTS)	DEGREE OF OVERLAP across classes
CRITERIA	*-For each INPUT class is there:* *··An even distribution across wrong ACTIONS* *OR* *··An uneven distribution (i.e., pile up) across wrong ACTIONS* *-For each ACTION is there:* *··An even distribution across INPUT classes* *··An uneven distribution across INPUT classes*	*-For two or more classes of INPUTS is there:* *··Overlap in the type of distribution across ACTIONS* *··Non-overlap in the type of distribution across ACTIONS* *-For two or more ACTIONS is there:* *··Overlap in the type of distribution across INPUT classes* *··Non-overlap in the type of distribution across INPUT classes*
INTERPRETATION	For INPUTS: -Uneven distribution for an INPUT class means that there is a systematic error for that class; -Even distributions for an INPUT class means non-systematic errors for that class For ACTIONS: -Uneven distribution for an ACTION means a systematic error -Even distributions for an ACTION means a non-systematic error	-The more overlap in an even distribution of errors there is, the more likely is there a failure to discriminate among classes -The less overlap there is in an uneven distribution, the more likely is the failure to be one of association

J.2.3

EXAMPLES ILLUSTRATING VARYING DEGREES OF OVERLAP (EXAMPLES ARE HYPOTHETICAL TO STRESS PARTICULAR PATTERN)

EXAMPLES

#1

CLASS OF ACTION TAKEN

INPUT CLASSES	I	II	III	IV	V	omissions
I	correct 1	1	1	0	0	1
II	1	correct 0	1	1	1	0
III	0	1	correct 1	1	0	1
IV	1	0	1	correct 0	1	1
V	1	1	0	1	correct 0	1

#1

- The distribution of errors, omissions, and correct items is even:
  - ··For INPUTS across ACTIONS
  - ··For ACTIONS across INPUTS
- The overlap among INPUT classes and among ACTIONS is high

The most probable failure is: discriminations

#2

CLASS OF ACTION TAKEN

INPUT CLASSES	I	II	III	IV	V	omissions
I	correct 0	3	0	0	0	1
II	0	correct 1	3	0	0	0
III	4	0	correct 0	0	0	0
IV	0	0	0	correct 2	0	2
V	0	0	0	0	correct 5	0

#2

- The distribution of errors, omissions, and correct items is relatively uneven:
  - ··For INPUTS across ACTIONS
  - ··For ACTIONS across INPUTS
- The overlap among INPUT classes and among ACTIONS is low

The most probable failure is: associations

#3

CLASS OF ACTION TAKEN

INPUT CLASSES	I	II	III	IV	V	omissions
I	correct 1	0	3	0	0	0
II	2	correct 0	2	0	0	0
III	1	1	correct 0	1	1	0
IV	0	0	0	correct 2	2	0
V	0	0	1	1	correct 1	1

#3

- The distribution of errors, omissions, and correct items is neither even nor uneven
- The overlap among INPUT classes and among ACTIONS is neither high nor low

The pattern is not readily interpretable. However, some of the specific confusions (mismatchings) are identified

LESSON [ ] (SUB-) CRITERION BEHAVIOR [ ] STUDENT ANALYSIS

RECALL items

CLASS OF ACTION TAKEN

INPUT CLASSES	I	II	III	IV	V	omissions
I	correct					
II		correct				
III			correct			
IV				correct		
V					correct	

SUMMARY OF NO. OF ITEMS

INPUT CLASS	correct	omission	consistent mismatching	inconsistent mismatching
I				
II				
III				
IV				
V				

RECALL PATTERN

	correct	omission	consistent mismatching	inconsistent mismatching
no classes				
some classes				
all classes				

TRANSFER items

CLASS OF ACTION TAKEN

INPUT CLASSES	I	II	III	IV	V	omissions
I	correct					
II		correct				
III			correct			
IV				correct		
V					correct	

SUMMARY OF NO. OF ITEMS

INPUT CLASS	correct	omission	consistent mismatching	inconsistent mismatching
I				
II				
III				
IV				
V				

TRANSFER PATTERN

	correct	omission	consistent mismatching	inconsistent mismatching
no classes				
some classes				
all classes				

RECALL items

CLASS OF ACTION TAKEN

INPUT CLASSES	I	II	III	IV	V	omissions
I	correct					
II		correct				
III			correct			
IV				correct		
V					correct	

SUMMARY OF NO. OF ITEMS

INPUT CLASS	correct	omission	consistent mismatching	inconsistent mismatching
I				
II				
III				
IV				
V				

RECALL PATTERN

	correct	omission	consistent mismatching	inconsistent mismatching
no classes				
some classes				
all classes				

TRANSFER items

CLASS OF ACTION TAKEN

INPUT CLASSES	I	II	III	IV	V	omissions
I	correct					
II		correct				
III			correct			
IV				correct		
V					correct	

SUMMARY OF NO. OF ITEMS

INPUT CLASS	correct	omission	consistent mismatching	inconsistent mismatching
I				
II				
III				
IV				
V				

TRANSFER PATTERN

	correct	omission	consistent mismatching	inconsistent mismatching
no classes				
some classes				
all classes				

USE OF "DELAYED" TESTING

	page
Two times at which to administer tests: "immediate" and "delayed" basis	152
In which parts of the developmental tryout cycle should these two types of testing be used?	153

J.2.3
IDENTIFICATION
MATRIX

	DIFFERENT PURPOSES IN DEVELOPMENTAL TESTING FOR PROFICIENCY AT DIFFERENT TIMES	
TIME OF TESTING	Testing IMMEDIATELY AFTER students complete program	Testing ON A DELAYED BASIS after students complete program
CRITERIA	*-Purpose is to determine whether:* *··Students have acquired sub-criterion and criterion behaviors* *··What types of failures have occurred (which skills are not adequately learned)*	*-Purpose is to determine whether:* *··Students have retained what they had already acquired from the program* *··Which specific skills are forgotten*

J.2.3

DECISION MATRIX

DETERMINING IN WHICH PART OF DEVELOPMENTAL CYCLE TO ADMINISTER TESTS ON AN IMMEDIATE AND DELAYED BASIS

TYPE OF TESTING	IMMEDIATE	DELAYED
ACTION TO TAKE	-*Administer an "immediate" after test on:* ••*Each and every cycle of developmental tryout; i.e., if, for example, there are three cycles of tryout, "immediate" tests would be administered on all three occasions*	-*Administer a "delayed" after test on:* ••*Later stages of the development tryout cycle; i.e., if, for example, there are three cycles of tryout, "delayed" tests would be administered only after the third cycle* *OR* ••*Administer the delayed test after a tryout in which high proficiency has been demonstrated and consequently little revision made on the program*
RATIONALE	It is important to determine whether students were able to acquire what they were supposed to learn	If students did not in the first place acquire criterion behaviors, delayed testing would not be diagnostic of retention problems (since no retention could be expected to occur)

ASSESSING "SEQUENCING" DECISIONS

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Differences between sequencing decisions made in Task C and in Task G	156
Two methods for assessing sequencing decisions regarding separate criterion behaviors	157
Two methods for assessing sequencing decisions regarding components within a single criterion behavior	158

**SECTION "J" up to this point has been concerned with assessing student proficiency at a single criterion behavior (and at the sub-criterion behaviors which make it up). The next several pages are concerned with assessing proficiency at two or more criterion behaviors as a means of determining the adequacy of sequencing decisions made in TASK "C."*

J.2.3

IDENTIFICATION **MATRIX**

DIFFERENCES BETWEEN SEQUENCING DECISIONS MADE IN TASK "C" AND IN TASK "G"

TASKS	Sequencing decisions in TASK "C"	Sequencing decisions in TASK "G"
CRITERIA	-*The decision is made as to the order in which a number of different criterion behaviors should be learned* -*The purpose of the decision is to sequence learning experiences so that prior mastery of criterion behaviors which can facilitate the learning of other criterion behaviors are taught earlier in the overall program*	-*The decision is made as to the order in which components of a single criterion behavior should be learned* -*Components ordered in various ways include:* ••*Sub-criterion behaviors* ••*Individual skills which make up the sub-criterion behaviors* -*The purpose is to order or sequence the learning of components so that mastery of the total criterion behavior will be most efficient*
EXAMPLES	e.g., -*Two criterion behaviors involve the following two concepts:* ••*Force* ••*Pressure* -*The decision has to be made in Task "C": In what order should the two concepts be taught so that learning can be optimized*	e.g., -*For teaching the concept "force" what is the optimum order for teaching the relevant:* ••*Discriminations* ••*Generalizations* ••*Associations* *involved in the concept*

J.2.3
IDENTIFICATION MATRIX

TWO POSSIBLE METHODS FOR ASSESSING THE ADEQUACY OF SEQUENCING DECISIONS MADE IN TASK "C" (REGARDING SEPARATE CRITERION BEHAVIORS)

METHODS	EXPERIMENTAL*	STATISTICAL*
CRITERIA	-During developmental tryout (preferably late in the tryout and revision cycle when the instructional program for each criterion behavior results in relatively high proficiency) the programs for two or more separate criterion behaviors can be administered to different groups of tryout students in different orders: ••Group 1 learns criterion behavior A first and B second ••Group 2 learns criterion behavior B first and A second -The groups are then compared for differences in: ••Time to complete the instructional program related to each criterion behavior ••Number of errors in the instructional program ••Scores on proficiency tests (difference between "before" and "after" scores) -If A should precede B, as originally decided, there should be substantial and significant differences between the two groups	-During developmental tryout (preferably early in the tryout and revision cycle when there are still relatively wide differences among students in performance on criterion tests or on programs) groups may be composed on one of the following bases: ••Number of errors on program for criterion behavior A ••Time to complete program for criterion behavior A ••Proficiency scores on test for criterion behavior A -Two groups are formed: ••A high scoring group ••A low scoring group on the variable selected above -Their scores for criterion behavior B are then compared on the same variable or on other variables -(An alternative to group comparison is to compute a correlation between scores on A and on B) -If A should, in fact, precede B, high achievers on A should be relatively higher achievers on B; and low achievers on A should be relatively lower achievers on B
EXAMPLES	e.g., -Group 1 would take the program on: ••Force first, and ••Pressure second -Group 2 would take the program on: ••Pressure first, and ••Force second	e.g., -High achievers on the "force" test and low achievers on the "force" test should be compared for achievement on the "pressure" test ("force" having been taught to all before "pressure") -Controlling for ability: If "force" should precede "pressure," the highs on "force" should be the highs on "pressure"

J.2.3
IDENTIFICATION
MATRIX

TWO POSSIBLE METHODS FOR ASSESSING THE ADEQUACY OF SEQUENCING DECISIONS MADE IN TASK "G" (REGARDING COMPONENTS OF A SINGLE CRITERION BEHAVIOR)

METHODS	EXPERIMENTAL	STATISTICAL
CRITERIA	-During developmental tryout (preferably late in the tryout and revision cycle when the instructional program for each criterion behavior results in relatively high proficiency) the programs for two or more separate sub-criterion behaviors related to the same criterion behavior can be administered to different groups of tryout students in different orders: ••Group 1 learns sub-criterion behavior A first and B second ••Group 2 learns sub-criterion behavior B first and A second -The groups are then compared for differences in: ••Time to complete the instructional program related to each sub-criterion behavior ••Number of errors in the instructional program ••Scores on proficiency tests (difference between "before" and "after" scores) -If A should precede B, as originally decided, there should be substantial and significant differences between the two groups	-During developmental tryout (preferably early in the tryout and revision cycle when there are still relatively wide differences among students in performance on sub-criterion tests or on programs) groups may be composed on one of the following bases: ••Number of errors on program for sub-criterion behavior A ••Time to complete program for sub-criterion behavior A ••Proficiency scores on test for sub-criterion behavior A -Two groups are formed: ••A high scoring group ••A low scoring group on the variable selected above -Their scores for criterion behavior B are then compared on the same variable or on other variables -(An alternative to group comparison is to compute a correlation between scores on A and on B) -If A should, in fact, precede B, high achievers on A should be relatively higher achievers on B; and low achievers on A should be relatively lower achievers on B
EXAMPLES	e.g., The criterion behavior involves the concept force; sub-criterion behaviors involve "direction of force" and "strength of force" -Groups 1 and 2 would differ in the order in which they took that part of the program on "direction" and "strength" of a force	e.g., -High and low achievers regarding "direction" (taught first) would be compared for performance regarding "strength" (taught second) -Controlling for ability: There should be a difference between highs and lows on "strength" if the sequence is facilitative

JOB PROCEDURES

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Conditions requiring assessing developer sequencing decisions and student delayed retention	161
SUMMARY OF PROCEDURES	162
Adequacy of procedures for interpreting test results	163

J.2.3
DECISION MATRIX

PRIORITIES IN THE ANALYSIS OF TEST RESULTS AS A MEANS OF IDENTIFYING TYPES OF LEARNING FAILURES WHICH HAVE OCCURRED

PRIORITIES	1st Analysis of GROUP results	2nd Analysis of results of INDIVIDUAL students	3rd Use of special DIAGNOSTIC TESTS and INTERVIEWS See Sub-STEP J.2.4)
ACTION TO TAKE	-*ALWAYS start with GROUP results first* -*Analyse GROUP results in the following order:* *(1) Total test scores* *••Low error scores, do NOT continue* *••Relatively high error scores, continue* *(2) Test scores summed for all RECALL items and summed for all TRANSFER items* *(3) GROUP error score for individual test items*	-*Perform analysis of patterns on errors on multiple test items for INDIVIDUAL students ONLY WHEN prior analysis of GROUP results indicates the existence of major and extension problems and which are not readily diagnosed by group results*	-*Administer diagnostic tests (developed in TASK F) and conduct probing interviews ONLY WHEN the 1st and 2nd priority approaches both provide insufficient diagnostic information:* *••The types of learning failures still are indeterminate*
RATIONALE	-These types of analyses are easiest and least time-consuming to do -They can provide information that: ••There are no major learning problems (in which case no further analysis is needed) ••There are major problems (in which case further analysis is indicated - See next column)	-This is a time-consuming procedure and is therefore only undertaken when the GROUP approach provides insufficient evidence as to the types of learning failure which have occurred	-This, too, is a time-consuming procedure and is therefore undertaken when both the GROUP and INDIVIDUAL approaches provide insufficient evidence as to the types of learning failure which have occurred

J.2.3

IDENTIFICATION **MATRIX**

	IDENTIFYING CONDITIONS WHEN IT IS NECESSARY TO ASSESS FOR DELAYED RETENTION AND FOR SEQUENCING ADEQUACY	
TYPE OF ASSESSMENT	Assessing DELAYED RETENTION	Assessing effects of SEQUENCING DECISIONS
CRITERIA	*CONDITIONS* *-When statement of objectives calls for performance on a <u>delayed</u> basis, administer criterion tests to a tryout sample--late in the developmental cycle (when the program has already undergone one or two cycles of revision and has resulted in immediate (non-delayed) high proficiency)*	*CONDITIONS* *-It is always useful to assess the adequacy of sequencing decisions made both with respect to:* *··Separate criterion behaviors* *··Components within a single criterion behavior*

J.2.3

ILLUSTRATION SUMMARIZING PROCEDURES INVOLVED IN ADMINISTERING, SCORING, AND INTERPRETING RESULTS ON TESTS

#1

a. Administer criterion and sub-criterion tests to tryout sample of approximately 25-50 students immediately after their completion of the program

b. Score tests and record on FORM J.2(2)

c. Compute for the GROUP:

- ··Total error scores
- ··RECALL and TRANSFER scores
- ··Error scores on individual items

d. Select high error students on specific test items and analyze their errors on FORM J.2(1):

- ··Omissions
- ··Specific wrong ACTIONS taken

#2

-If further analysis is needed to identify types of learning failures:

a. For a sub-sample of approximately ten high error students, fill out FORM J.2(1)

b. Make up a template to score for error patterns on multiple test items which individual students exhibit

c. Identify the pattern and interpret it from tables in this section of the HANDBOOK

*Fill out a separate form for each student

#3

a. Administer tests on a delayed basis to students in later cycles of development tryout; assess retention

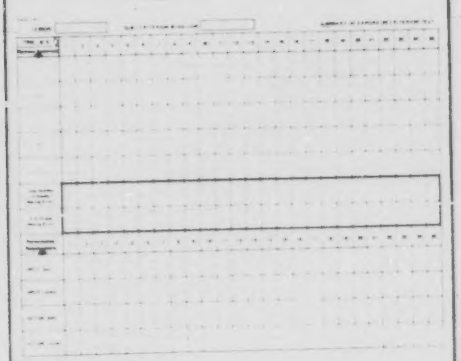
b. Assess sequencing decisions:

- ··Experimentally
- ··Statistically

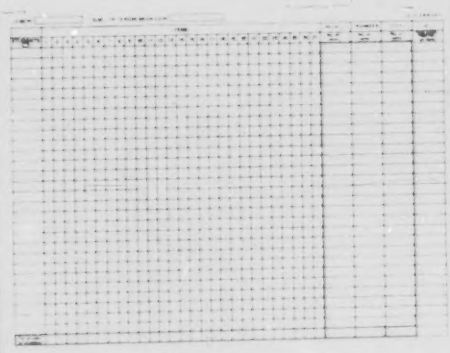
for two types of probes:

- ··Order of two or more criterion behaviors
- ··Order of components of a single criterion behavior

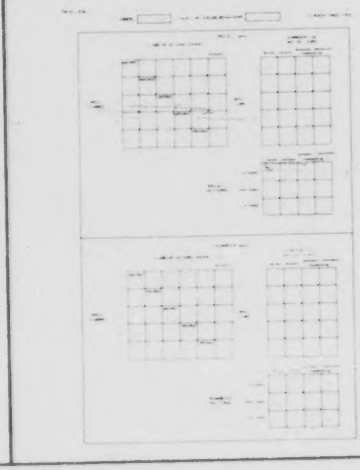
FORM J.2(1)



FORM J.2(2)



FORM J.2(3)



J.2.3

STANDARDS MATRIX

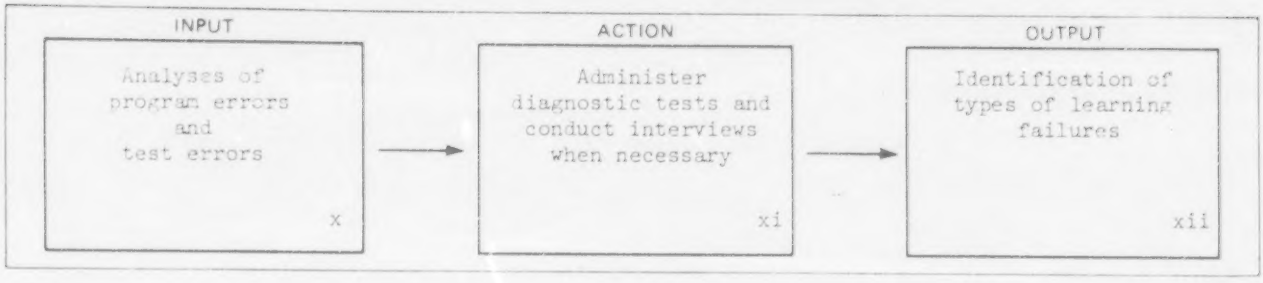
ASSESSING THE ADEQUACY OF PROCEDURES FOR INTERPRETING TEST RESULTS*

PROPERTIES	COMPLETENESS	EFFICIENCY	SAMPLING ADEQUACY
CRITERIA	-*GROUP error scores are analyzed for:* ••*Total number of students exceeding a predetermined error rate* ••*Differences between error rates for RECALL and TRANSFER items* ••*Distributions of wrong answers endorsed for each item* -*Individual error scores on multiple items are analyzed for patterns indicative of types of learning failures:* ••*Discriminations* ••*Generalizations* ••*Associations* -*Delayed tests are administered to assess "retention"* -*Analyses are conducted to determine adequacy of sequencing of program materials*	-*No more analyses (which are time-consuming) are performed than are required* -*Priorities in conducting analyses:* ••*GROUP analyses* ••*Individual analyses* ••*Special diagnostic procedures (See Sub-STEP J.2.4)*	*For GROUP Analyses:* -*Complete tryout sample used on "total" scores* -*For analysis of individual items only students who commit errors* *For Individual Analyses:* -*Approximately 10 students making a relatively high number of errors (e.g., 30%-60% error rate)*

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*An identification of the types of learning failures.*
WHAT YOU WILL WORK FROM	(1) Analyses of program errors. (2) Criterion test errors. (3) Diagnostic tests and interview schedules.
WHAT YOU WILL DO	(1) Administer diagnostic tests in order to identify types of learning failures (when necessary; i.e., not determined in the previous sub-steps). (2) Conduct interviews for the same purposes (when necessary).
FORMS YOU WILL USE	None

DESCRIPTION OF Sub-STEP	J.2.4



Job Aid Contents

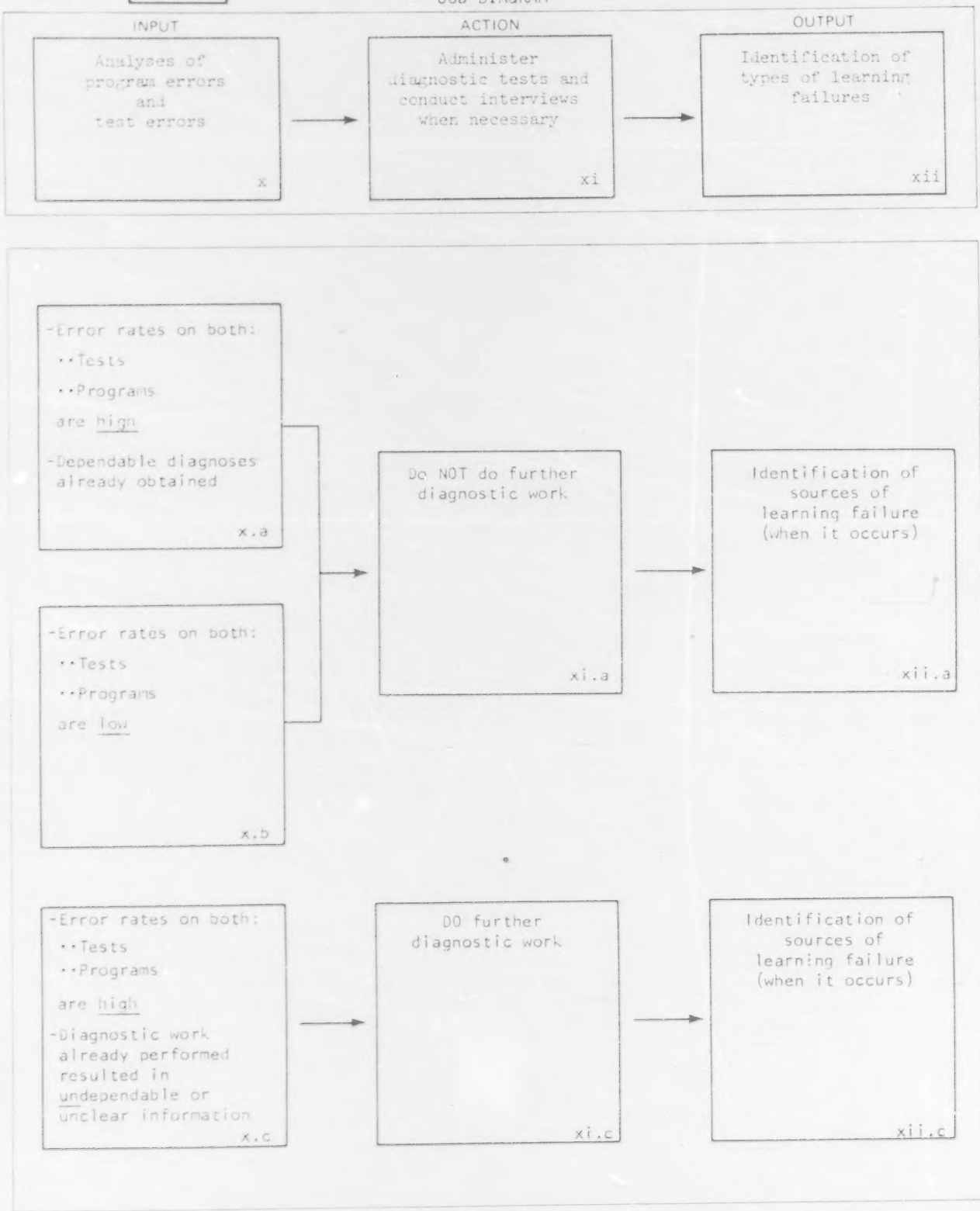
CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
-MATRIX: Information sources to review 168	-MATRIX: When to do further diagnostic work 163	-MATRIX: Adequacy of procedures involved in doing further diagnostic work 171	SUMMARY OF PROCEDURES . . 170

Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
Interpretation of learning failures	J.2.3			
Diagnostic tests and "probes"	F.3			

Sub- STEP J.2.4

JOB DIAGRAM



JOB PROCEDURES

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Information sources to review and types of information to obtain	168
Determining whether to do further diagnosis of types of learning failure	169
SUMMARY OF PROCEDURES	170
Assessing adequacy of procedures for conducting further diagnoses	171

J.2.4
IDENTIFICATION
MATRIX

	INFORMATION SOURCES TO REVIEW AND TYPES OF INFORMATION TO SEEK	
INFORMATION SOURCES TO REVIEW	FORM J.2(2) - TEST RESULTS and PERFORMANCE on PROGRAM	DIAGNOSES made from FORM J.2(3) and from FORM J.2(2)
CRITERIA	-*Proficiency on criterion tests and on sub-criterion tests:* ··*Percentage of students exceeding a predetermined error rate on tests** -*Error rates on program problems:* ··*Criterion program problems* ··*Sub-criterion program problems* /*Percentage of students exceeding a predetermined percentage**	-*Difference in RECALL/TRANSFER problems identified on FORM J.2(3)* -*Specific learning failures diagnosed from patterns of errors of individual students on multiple test items*

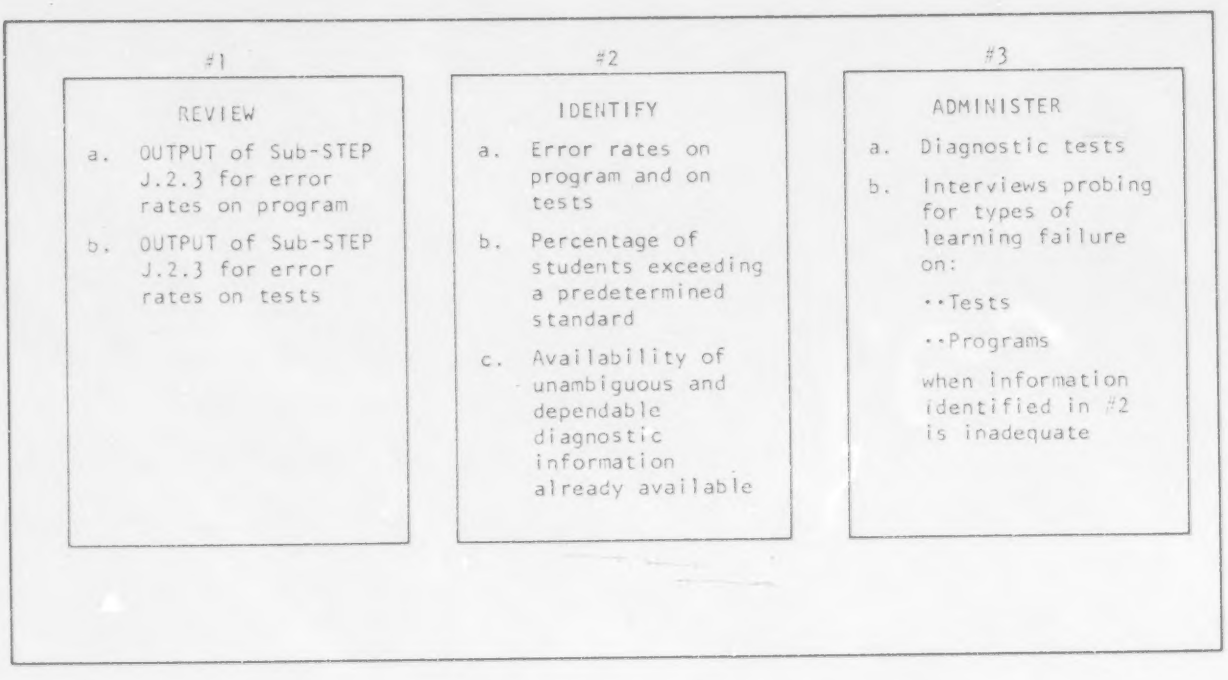
*A 20 percent error rate cutoff point is recommended.

J.2.4
DECISION
MATRIX

DETERMINING WHEN TO ADMINISTER DIAGNOSTIC TESTS AND TO PROBE FOR ERROR SOURCES DURING INTERVIEWS

CONDITIONS	-On tests and on programs a high percentage of students (80% or more) exceeding a 20% error rate AND -DEPENDABLE diagnoses obtained from analysis of GROUP and INDIVIDUAL results	-On tests and on programs a high percentage of students (80% or more) exceeding a 20% error rate AND -Diagnoses based on GROUP and INDIVIDUAL results are NOT sufficiently dependable or clear	-On tests and on programs a high percentage of students (80% or more) makes fewer than 20% errors
ACTION TO TAKE	*-Do NOT do further diagnostic work*	*-Administer diagnostic tests developed in TASK "F" (developing additional tests at this time if needed)* *-Conduct interviews with "high error" students:* *••Re: test errors* *••Re: program errors*	*-Do NOT do any diagnostic work*

J.2.4 ILLUSTRATION SUMMARIZING PROCEDURES FOR DETERMINING WHETHER TO AND FOR DOING FURTHER DIAGNOSTIC WORK


#1
REVIEW
a. OUTPUT of Sub-STEP J.2.3 for error rates on program
b. OUTPUT of Sub-STEP J.2.3 for error rates on tests
#2
IDENTIFY
a. Error rates on program and on tests
b. Percentage of students exceeding a predetermined standard
c. Availability of unambiguous and dependable diagnostic information already available
#3
ADMINISTER
a. Diagnostic tests
b. Interviews probing for types of learning failure on:
••Tests
••Programs
when information identified in #2 is inadequate

J.2.4
STANDARDS
MATRIX

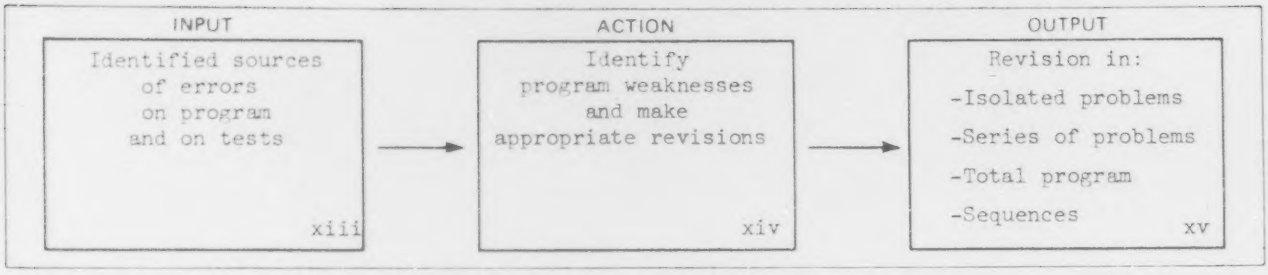
ASSESSING THE ADEQUACY OF PROCEDURES
FOR DIAGNOSING SOURCES OF ERRORS

PROPERTIES	EFFICIENCY	COMPLETENESS
CRITERIA	-*Diagnostic tests and interviews are used only when:* ··*There are high error rates on program and on tests* *AND* ··*It is unclear from analyses of these errors what the sources of errors are*	-*Sources of errors (i.e., whether there was a discrimination, generalization, association, or chaining failure) for:* ··*Each sub-criterion behavior covered by the program* *AND* ··*The criterion behavior covered by the program*

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*A revision in part(s) of or in all of the program.*
WHAT YOU WILL WORK FROM	(1) Identified types of learning failures (2) Identified sources of failures
WHAT YOU WILL DO	(1) Identify program weaknesses (2) Revise program accordingly
FORMS YOU WILL USE	None

DESCRIPTION OF Sub-STEP	J.2.5



Job Aid Contents

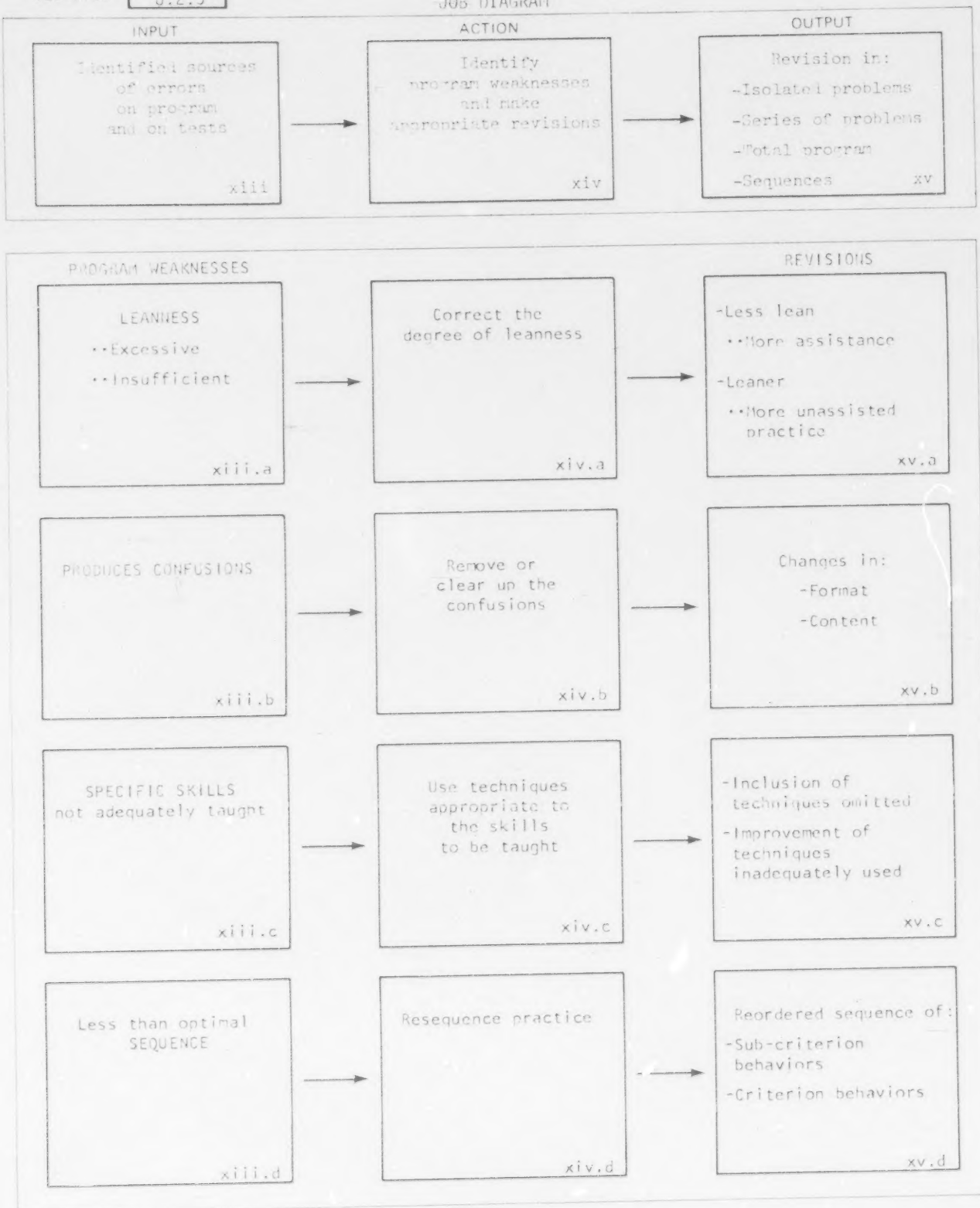
CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
-MATRIX: Four degrees of program revision . . . . 178 -MATRIX: Identifying weaknesses in program 184, 190-195, 204-206	-MATRIX: Deciding on the degree of program revision . . . . 180 -MATRIX: How to revise programs . . . . 186, 196-201, 207 -MATRIX: Revising sequences . 210-212	-MATRIX: Adequacy of program revision 217	SUMMARY OF PROCEDURES . . . 216

Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
Interpretation of program and test errors	J.2.3	FORMS: J.2(1) J.2(2) J.2(3)	J.2.4	
Diagnostic results	J.2.4			

Sub-STEP J.2.5

JOB DIAGRAM



BACKGROUND INFORMATION

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Identification of program weaknesses through direct evidence and through inference	177
Four degrees of program revision	178, 179
Conditions calling for the four degrees of program revision	180, 181
Priorities in deciding how much of the program to revise	182

J.2.5

OVERVIEW OF THE TRYOUT AND REVISION PROCESS: SUB-STEPS J.2.1 - J.2.5

INFORMATION SOURCES	INFORMATION OBTAINED	TYPES OF LEARNING FAILURES IDENTIFIED	PROGRAM WEAKNESSES IDENTIFIED	REVISIONS TO BE MADE IN PROGRAM
-Test scores (ERRORS) ··Sub-criterion scores and criterion scores ··Total test scores, subtest scores, individual item scores, and frequency of endorsements of particular answers ··Scores for groups and for individuals -Program errors ··Criterion problems, sub-criterion problems, individual problems, and specific answers exhibited -Special diagnostic procedures ··Diagnostic tests ··Interviews	-Proficiency levels ··"Before" and "after" instruction ··On criterion and sub-criterion behaviors ··On differential types of behaviors /RECALL/TRANSFER /Component skills (discriminations, generalizations, associations, and chains) /Immediate and delayed retention /Specific information ··On other inter-related criterion behaviors: /Taught elsewhere in the same program /Taught in other programs -Diagnostic information ··Frequency of specific errors ··Student errors in attention to features of the program ··Specific types of learning failures	-Types of failures ··No learning ··Incorrect learning -Acquisition failures ··Discriminations ··Generalizations ··Associations ··Chains -Sources of failures ··Properties of INPUTS, ACTIONS, or their associations contributing to the failures -Retention failures (Same component skills as in "acquisition") -Performance failure ··RECALL ··TRANSFER	-Types of practice provided by the program ··Omissions of relevant practice ··Insufficient amount of practice ··Inadequate, confusing, or misleading practice ··Poorly sequenced practice	-Changes in type of practice provided ··Inclusion of practice omitted ··Increase in the amount of practice ··Revision of program sections producing errors ··Resequencing of program sections devoted to different criterion behaviors

J.2.5

IDENTIFICATION MATRIX

TWO SOURCES FOR IDENTIFYING PROGRAM WEAKNESSES

SOURCES	DIRECT EVIDENCE	INFERENCE*
CRITERIA	-Student reports in diagnostic interviews directly identify: ··Vocabulary sentence difficulties ··Difficulties understanding instructions or a statement of objectives ··Examples of problem features that caused them difficulties -Alternating program sequences produce differential performance results -Errors on specific program problems: ··Individual problems ··A series of problems	-Student behavior on tasks: ··Does something counter to instructions provided ··Fails to do what instructions require -Results on tests: ··Number of errors ··Types of wrong answers ··Patterns of errors ··Errors on problems linked to specific component skills

*The burden of identifying program weakness usually lies most on inference from program and test results.

EXAMPLES	e.g., student reports of difficulties with specific features of a program provide direct evidence of program weaknesses e.g., if a comparison of results for program sections administered in different orders produces differential results, this is direct evidence of what the optimum sequence is (and conversely what is a poor sequence)	e.g., a specific wrong answer produced by a large percentage of the trynout sample suggests the possibility of the program having produced the misconception e.g., a high percentage of errors on preparatory program problems and on criterion problems suggests a total instructional sequence insufficiently cued to produce error-free performance

J.2.5
IDENTIFICATION
MATRIX

FOUR POSSIBLE AMOUNTS OF PROGRAM REVISION
(On this and on opposite page)

POSSIBLE AMOUNTS OF PROGRAM CHANGE	1 Changes in ISOLATED (individual) problems throughout the instructional program	2 Changes in a SEQUENTIAL SERIES of (several) problems in the instructional program
CRITERIA	-*Changes are made in individual program problems (or individual program tasks)* -*Changes made on each problem are unrelated to changes made in other program problems*	-*Changes are made in a number of serially ordered program problems (but the number is less than that involved in the whole program)* -*Changes made in each problem are related to the changes made in other problems in the series (because performance on one problem affects performance on the next, etc.)*
	e.g., *On a program involving 125 practice problems dealing with a criterion behavior, changes may be made in:* -*The following isolated problems:* ..12, 29, 47, 89, 103, 116, etc.	-*The following series of problems:* ..12, 13, 14, 15, 16, and 17 ..103, 104, 105, 106, 107, 108, and 109
	e.g., *On a program involving practice of 78 steps involved in a procedural task, changes may be made in practice involving:* -*Steps 5, 26, 32, 68, etc.*	-*Steps 5, 6, 7, 8, and 9*

J.2.5
IDENTIFICATION
MATRIX

FOUR POSSIBLE AMOUNTS OF PROGRAM REVISION
(On this and on opposite page)

POSSIBLE AMOUNTS OF PROGRAM CHANGE	3 Changes in the ENTIRE PROGRAM related to ••A sub-criterion behavior ••A criterion behavior	4 Changes in the SEQUENCE of programs ••For separate sub-criterion behaviors (re: the same criterion behavior) ••For different criterion behaviors
CRITERIA	-*Changes are made in the entire instructional program (but not necessarily on <u>every</u> problem or on every part of a practice task) related to one or both of the following:* ••*A sub-criterion behavior* ••*A criterion behavior* -*Changes made are interrelated to one another*	-*Only the sequence with which intact programs (or intact parts of programs) are administered is altered*
EXAMPLES	e.g., *On a program involving 125 practice problems dealing with a <u>criterion</u> behavior, changes may be <u>made in</u>:* -*The entire series of program problems from 1-125 (although not necessarily in all problems)* e.g., *On a program involving practice of 78 steps involved in a procedural task, changes may be made in practice involving:* -*Practice for the entire series of steps (1-78) may be changed*	e.g., -*The sequence in which separate programs for criterion behavior A and criterion behavior B are administered may be reversed* e.g., -*The sequence in which program sections (within the same overall program) for sub-criterion behaviors A and B (both related to the <u>same</u> criterion behavior) may be <u>reversed</u>*

J.2.5

IDENTIFICATION MATRIX

IDENTIFYING CONDITIONS CALLING FOR VARYING DEGREES OF PROGRAM REVISION
(On this and on opposite page)

AMOUNT OF PROGRAM REVISION	1 CONDITIONS calling for: Changes in ISOLATED (individual) problems throughout the instructional program	2 CONDITIONS calling for: Changes in a SEQUENTIAL SERIES of (several) problems in the instructional program
CRITERIA	*ERROR RESULTS* *-% of people: less than 20%* *Error rate: more than 20%* *••On the total instructional program* *and* *••On the sub-criterion and criterion tests covering the program* *AND* *-% of people: more than 20%* *Error rate: more than 20%* *••On individual, isolated program problems or program tasks*	*ERROR RESULTS* *-% of people: less than 20%* *-Error rate: more than 20%* *••On the total instructional program* *and* *••On the sub-criterion and criterion tests covering the program* *AND* *-% of people: more than 20%* *Error rate: more than 20%* *••On a sequential series of program problems or tasks* *and/or* *••On test items testing for material covered by the series of problems*
EXAMPLES *Program:* *••Has 100 problems* *Test:* *••Has 25 items*	e.g., RESULTS *-Total program: 11% of sample makes more than 20% errors* *-Total test: 16% of sample makes more than 20% errors* AND *-On program: More than 20% of the sample makes errors on problems: #'s 6, 19, 32, 41, 82, etc.*	e.g., RESULTS *-Total program: 9% of sample makes more than 20% errors* *-Total test: 12% of sample makes more than 20% errors* AND *-On program: More than 20% of the sample makes errors on a series of problems: #'s 6, 7, 8, 9, 10, 11, 12, and 13* AND *-On test: 22% of the sample makes errors on all test items related to content covered in program problem #'s 6-13*

J.2.5

IDENTIFICATION MATRIX

IDENTIFYING CONDITIONS CALLING FOR VARYING DEGREES OF PROGRAM REVISION
(On this and on opposite page)

POSSIBLE AMOUNTS OF PROGRAM CHANGE	3 CONDITIONS calling for: Changes in the ENTIRE PROGRAM related to ••A sub-criterion behavior ••A criterion behavior	4 CONDITIONS calling for: Changes in the SEQUENCE of programs ••For separate sub-criterion behaviors (re: the same criterion behavior) ••For different criterion behaviors
	ERROR RESULTS *-% of people: More than 20%* *-Error rate: More than 20%* *••On total instructional program and/or* *••On criterion and/or sub-criterion tests*	*EXPERIMENTAL assessment of sequence suitability* *-Sequence A-B yields a lower error rate:* *••On Program A and on Program B and* *••On tests for A and for B* *than the sequence B-A* *STATISTICAL assessment of sequence suitability* *-Test results* for programs A and B:* *••Low error scores on A tend to be low error scores on B* *••High error scores on A tend to be high error scores on B*
EXAMPLES *Program:* *••Has 100 problems* *Test:* *••Has 25 items*	e.g., RESULTS *-In the sequence A-B, the average error rate on tests for A and B was 38%* *-In the sequence B-A, the average error rate on tests for A and B was 29%*	e.g., RESULTS *-In the sequence A-B, the average error rate on tests for A and B was 18%* *-In the sequence B-A, the average error rate on tests for A and B was 7%*

*Test results used in this way can be for programs under development or for existing programs which are thought to produce prerequisite entering behaviors.

J.2.5

DECISION MATRIX

DETERMINING HOW MUCH OF THE INSTRUCTIONAL PROGRAM TO REVISE

CONDITIONS	Error rates: on TESTS and/or on PROGRAM are: ··Low (less than 20%) ··For most of the tryout sample (more than 30%)	Error rates: on TESTS and/or on PROGRAM are: ··High (more than 20%) ··For a large part of the tryout sample (more than 20%)	Error rates: on TESTS and/or on PROGRAM are: ··Substantially different for alternative sequences (whether overall error rates are high or low)
ACTION TO TAKE	-*Do not plan extensive program revision* -*Identify individual program problems or series of program problems on which high error rates have occurred; revise these program problems*	-*Plan a revision of the entire program* -*Make revisions:* ··*In those individual practice problems or* ··*In the series of practice problems* *on which results indicate:* ··*High error rates and/or* ··*High error rates on test problems related to program problems*	-*Alter the sequence of practice:* ··*Practice related to two or more sub-criterion behaviors related to the same criterion behavior* *OR* ··*Practice related to two or more different criterion behaviors* -*Make changes in the programs themselves according to the adjacent columns*

REVISING
INDIVIDUAL PRACTICE PROBLEMS

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Sources of information about weaknesses of individual practice problems	184
Types of weaknesses in individual practice problems	185
Revisions to make in individual practice problems to eliminate weaknesses	186, 187

J.2.5
IDENTIFICATION
MATRIX

SOURCES OF INFORMATION ABOUT WEAKNESSES OF INDIVIDUAL (ISOLATED) PRACTICE PROBLEMS*

SOURCES	"GROUP" ERROR SCORES on program recorded on FORM J.2(1)	TYPES OF PROGRAM PROBLEMS on which errors are made: identified on FORM J.2(1)	INTERVIEWS and/or OBSERVATIONAL DATA
CRITERIA	-The magnitude of the percentage of tryout students who made errors on program problems (or tasks) identifies which program problem is in need of revision -The frequency of particular wrong answers or particular wrong procedures identifies the probable nature of the problem: ··Omissions ··Even distribution among wrong answers ··Uneven distribution among wrong answers	-Sub-criterion program problems and criterion program problems are identified on FORM J.2(1) -Error rates for individual items obtainable from "GROUP" scores (the colum to the left) can be treated differently for: ··Problems or tasks which are part of a progression (leading up to a criterion behavior) AND ··Problems which involve criterion (or sub-criterion) behavior	-Interviews provide for student identification of difficulties with: ··Vocabulary, sentence complexity or length ··Instructions or statement of objectives ··Attention or observation control techniques ··Content of problem -Observation provides for identification of student difficulties with: ··Attention or observation control techniques ··Content of problem or task

*Except for those program problems which involve sub-criterion or criterion behavior, test data usually provide no dependable information that can be easily traced back to individual program problems. See the next section for ways to treat situations in which errors occur (either on the program or on the test) on measures of sub-criterion or criterion behavior.

J.2.5
DECISION MATRIX

IDENTIFYING NATURE OF WEAKNESS IN A PROGRAM PROBLEM OR TASK ON THE BASIS OF AVAILABLE DATA

DATA AVAILABLE	••Omission or answer or of procedure ••Failure to attend or observe (as intended) ••Student report of not understanding	••A particular wrong answer produced by many students ••Frequent attention to a wrong problem feature	••A variety of wrong answers produced by many students
ACTION TO TAKE	*INTERPRET as evidence of one or more of the following:* *-Vocabulary or language complexity inappropriate for target audience* *-Absence of or incomplete:* *••Task instructions* *••Techniques to control attention/ observation* *-Insufficient cuing to enable a correct response at that point in a progression*	*INTERPRET as evidence of one or more of the following:* *-Task instructions or attention control techniques are:* *••Absent, incomplete* *••Misleading* *-Cuing provided for the problem may be:* *••Insufficient* *••Misleading*	*INTERPRET as evidence of:* *-Cuing provided for the problem may be insufficient at that point in the progression*
EXAMPLES	e.g., *-Vocabulary level or sentence length may be inappropriate for the age or grade of the students in the target audience*	e.g., *-Visual devices (arrows, charts) designed to control attention may be ambiguous or unclear causing student to attend to wrong information* *-Clues provided with a problem may mislead students into producing a particular wrong answer*	e.g., *-Cuing may have been totally withdrawn in a problem too soon* *-Partial cuing provided (i.e., indirect assistance) may be inadequate for the problem*

J.2.5
DECISION
MATRIX

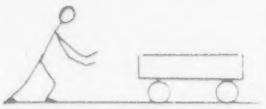
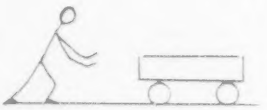
DETERMINING HOW TO REVISE INDIVIDUAL PROGRAM PROBLEMS OR TASKS TO OVERCOME IDENTIFIED WEAKNESSES

CONDITIONS	Problem FORMAT ••Insufficient or ••Misleading	BEHAVIOR CONTROL TECHNIQUES ••Insufficient or ••Misleading	CUING ••Insufficient for the problem ••Misleading
	-*Simplify or clarify* ••*Vocabulary* ••*Sentence structure* ••*Task instructions*	-*Simplify or clarify* ••*Attention or observation control techniques or devices*	-*If no cuing has been provided, consider the following possibilities:* ••*Changing the example to an easier one (e.g., one already practiced) and leaving out cuing again* ••*Adding indirect or partial cuing* -*If indirect or partial cuing was used originally, make it stronger* -*Do not resort to direct (complete) cuing unless the problem is one occurring very early in a progression*
EXAMPLES	e.g., -*Cut down sentence length* -*Use high frequency words in place of low frequency words* -*Use everyday language in place of literary language or technical language*	e.g., -*Make attention control devices larger, more prominent, easier to follow, etc.* -*Provide for attention control when it is missing; e.g., "Look at the distance the load is from the fulcrum on this lever."*	SEE OPPOSITE PAGE

J.2.5

EXAMPLES ILLUSTRATING HOW WEAKNESSES OF INDIVIDUAL PROGRAM PROBLEMS OR TASKS CAN BE OVERCOME BY CHANGING CUING

EXAMPLES

LEVELS OF CUING	ORIGINAL PROBLEM	MORE CUING	STILL MORE CUING
#1	The man has just applied a force to the cart. In what direction must the cart be moving? _____	 The man has just pushed the cart. In what direction must the cart be moving? _____	 The man has just pushed the cart. The cart must be moving in the same direction. In what direction must the cart be moving? _____
#2	Concentrate on making a correct loop (as you thread this film projector).	Concentrate on making a loop (as you thread this film projector). Make sure the loop is neither too long nor too short.	Concentrate on making a loop (as you thread this film projector). Make sure the loop does not exceed these guide marks. (Guide marks provided)
#3	What class of lever is this?	What class of lever is this? A substitution of example makes this an easier problem.	Note that the resistance force is between the fulcrum and effort force. What class of lever is this?

REVISING
SEQUENTIAL SERIES OF PRACTICE PROBLEMS

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Types of weaknesses in a series of practice problems	191-195
Revisions to make in a series of practice problems	196-201

J.2.5
IDENTIFICATION
MATRIX

SOURCES OF INFORMATION ABOUT WEAKNESSES
OF A SEQUENTIAL SERIES OF PRACTICE PROBLEMS

SOURCES	ERROR data on PROGRAM	ERROR data on TESTS	INTERVIEWS and/or OBSERVATIONAL DATA
CRITERIA	*From: FORM J.2(1)* *-An identification of a series of program problems on which a relatively high frequency of errors has occurred* *-An identification of a series of errors in which:* *··Errors occur only on a number of sub-criterion problems but NOT on the preparatory progression problems leading up to them* *OR* *··Errors occur on the preparatory progression problems and the sub-criterion or criterion problems* *-An identification (independent of error data) of what a series of program problems was designed to teach* *··Specific component skills* *··Combination of skills*	*From: FORM J.2(2)* *-GROUP error data on items traceable back to a series of program problems* *··Error data on a number of test items* *··RECALL/TRANSFER error data* *From: FORM J.2(3)* *-INDIVIDUAL error patterns traceable back to a series of program problems:* *··Difficulties with specific component skills identified*	*Interviews or observation provide information about difficulties students have with a series of program problems* *(See page 184)*

J.2.5

DECISION MATRIX

IDENTIFYING THE NATURE OF PROGRAM WEAKNESS BASED ONLY ON ERROR DATA ON PROGRAM PROBLEMS OR TASKS*

DATA AVAILABLE	High error rate both on: ••Preparatory problems and on ••Sub-criterion problems (which follow them)	High error rate ••Only on a series of sub-criterion problems (or criterion problems) ••But NOT on the preparatory progression problems which precede them	High error rate on: ••A series of program problems which do not end in a sub-criterion behavior (there are additional problems before sub-criterion problems are reached)
ACTION TO TAKE	*INTERPRET* ••Multiple omissions, or ••Multiple and varied wrong responses as evidence of: -An excessively lean progression: ••Insufficient cuing of responses to examples provided ••Insufficient number of program problems (offering different examples) ••A less than optimum sequence of problem examples	*INTERPRET* ••Multiple omissions, or ••Multiple and varied wrong responses, or ••Multiple, systematic wrong responses as evidence of one or more of the following: -Too rapid fading of cues before sub-criterion problems -Failure to provide the types of or number of problems relevant to sub-criterion (or criterion) behavior -Failure to provide practice with TRANSFER problems that would facilitate TRANSFER to sub-criterion problems -A program sequence which is excessively NON-lean (i.e., too much assistance is provided)	*INTERPRET* ••Multiple omissions, or ••Multiple and varied wrong responses, or ••Multiple, systematic wrong responses as evidence of one or more of the following: -An excessively lean sequence: ••Insufficient cuing to problems provided -A less than optimum sequence of problems: ••Sequence of examples is less than optimum
EXAMPLES	e.g., -The amount or strength of cuing for the examples provided is insufficient for individual problems in the series or the fading of cuing is made too abruptly -The number of problems provided is too small to enable the student to be able to progress to the sub-criterion problem	e.g., -The variety of examples used in the practice progression is too small or thin to enable the student to TRANSFER skills to new examples provided in sub-criterion problems -Too much assistance is provided and not faded out at all (accounting for low errors on preparatory problems and high errors on sub-criterion problems	e.g., -Difficult examples occur in a sequence before easier ones (i.e., examples which require more difficult transfer come earlier than ones which require less difficult transfer)

*Identification of program weaknesses can be even more dependably made when test data (See next page) confirm the interpretations made on the basis of program data.

J.2.5

DECISION MATRIX

IDENTIFYING THE NATURE OF WEAKNESS IN A SERIES OF PROGRAM PROBLEMS BASED ONLY ON "GROUP" TEST DATA (RELEVANT TO PROGRAM PROBLEMS ON WHICH ERRORS OCCURRED)

TEST RESULTS	GROUP error scores on tests: ••Frequent omissions or ••Frequent variable wrong answers	GROUP error scores on tests: ••Frequent systematic wrong answers	GROUP error scores on tests: ••Few errors on RECALL items ••Frequent errors on TRANSFER items
ACTION TO TAKE	*INTERPRET as evidence of:* *-An excessively lean progression due to one or more of the following:* *••Insufficiently strong cuing* *••An insufficient number of examples or problems* *••Premature or abrupt fading of cues*	*INTERPRET as evidence of:* *-An excessively lean progression due to one or more of the following:* *••Insufficient variation in examples or problems* *-Provision of misleading cues in program problems:* *••Use of atypical examples* *••Ambiguous statement of rules pertaining to*	*INTERPRET as evidence of:* *-An excessively lean progression due to one or more of the following:* *••Insufficient variation in examples or problems provided*

J.2.5

DECISION MATRIX

IDENTIFYING THE NATURE OF WEAKNESS IN A SERIES OF PROGRAM PROBLEMS BASED ONLY ON "INDIVIDUAL" TEST DATA REVEALING DIAGNOSTIC PATTERNS (RELEVANT TO PROGRAM PROBLEMS ON WHICH ERRORS OCCURRED)

DIAGNOSTIC PATTERNS	Difficulties indicated for DISCRIMINATIONS	Difficulties indicated for GENERALIZATIONS	Difficulties indicated for ASSOCIATIONS
ACTION TO TAKE	*INTERPRET as evidence of:* *-Program failure to do one or more of the following:* *··Contrast INPUT classes* *··Identify the basis for the difference between classes* *··Identify the boundaries between (limits) classes* *··Provide sufficient cuing to enable discriminations to be made* *··Provide enough examples of differing classes*	*INTERPRET as evidence of:* *-Program failure to do one or more of the following:* *··Show similarities between members of each INPUT class* *··Identify the basis for the similarity between members of each class* *··Identify the limits of each class* *··Provide sufficient cuing to enable generalizations to be made* *··Provide enough or varying examples within each class*	*INTERPRET as evidence of:* *-Program failure to do one or more of the following:* *··Identify the basis for associating INPUT class and a given ACTION* *··Provide sufficient cuing to enable associations to be formed* *··Provide sufficient practice problems or examples to enable associations to be formed*

J.2.5

DECISION MATRIX

IDENTIFYING THE NATURE OF WEAKNESS IN A SERIES OF PROGRAM PROBLEMS BASED ONLY ON "DIAGNOSTIC" TEST DATA AND ON INTERVIEW/OBSERVATION (RELEVANT TO PROGRAM PROBLEMS ON WHICH ERRORS OCCURRED)

DATA	DIAGNOSTIC tests identify difficulties with specific component skills: ••Discriminations ••Generalizations ••Associations	INTERVIEW/OBSERVATION results: ••Student questions ••Student appearance of confusion ••Student doing something other than what instructed to do
ACTION TO TAKE	*INTERPRET as evidence of:* *-Program failure to deal with these skills* *(See page 193 for possible program failures which can account for each type of difficulty)*	*INTERPRET as evidence of:* *-Program failure to do one or more of the following:* *••Gear language difficulty to target audience* *••Provide for adequate control of attention, observation* *••Provide unambiguous instructions about tasks to be performed*

J.2.5

IDENTIFICATION **MATRIX**

TYPES OF PROGRAM WEAKNESS	THREE MAJOR TYPES OF PROGRAM WEAKNESS WHICH HAVE TO BE ELIMINATED*		
	(1) LEANNESS of program	(2) CONFUSIONS created by program	(3) SPECIFIC SKILLS not accommodated
CRITERIA	-*Excessively lean:* ••*Insufficient cuing in individual problems* ••*Too abrupt fading of cues in series of problems* ••*Insufficient number of program problems or examples* -*Insufficiently lean:* ••*Cuing maintained too long (not faded soon enough in series)* ••*No uncued problems provided*	-*Vocabulary, sentence structure, etc., inappropriate for the target audience* -*Omission of or ambiguous statement of:* ••*Objectives* ••*Task instructions* ••*Directions to control attention or observation* -*Examples used:* ••*Atypical* ••*Sequence of examples (difficult/easy rather than other way around)* -*Cues used:* ••*Call attention to wrong INPUT or ACTION features*	-*Techniques appropriate to teaching of specific skills are:* ••*Omitted* ••*Incompletely implemented*

*All these types of weakness may coexist in varying combinations. Program revision will, therefore, have to deal with any or all of them which characterize a series of program problems.

SEE PAGES	196-197	198-199	200-201

J.2.5

DECISION MATRIX

(1) DETERMINING HOW TO REVISE A SERIES OF PROGRAM PROBLEMS TO OVERCOME INAPPROPRIATE DEGREE OF LEANNESS

PROGRAM WEAKNESS	EXCESSIVE LEANNESS	INSUFFICIENT LEANNESS
ACTION TO TAKE	-*Deal with the series of problems before looking to individual problems:* ••*Reduce the abruptness of fading:* /*Maintain some type of cuing for more problems than before* /*Increase the strength of cuing (where cuing is already provided)* ••*Increase the number of problems* -*Deal with individual problems making cuing strength appropriate to each problem and where it is in the series* *(See pages 186-187)*	-*Add some program problems which:* ••*Have less cuing strength than the ones already in the program* ••*Provide an opportunity to fade out cues gradually, and* ••*Provide an opportunity for student practice of problems like the sub-criterion (or criterion) problems, i.e., with no cuing available*

EXAMPLES	SEE OPPOSITE PAGE

J.2.5

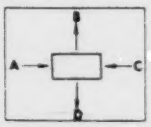
EXAMPLES

EXAMPLES ILLUSTRATING REVISIONS WHICH OVERCOME PROGRAM WEAKNESS DUE TO "LEANNESS"*

#1 EXCESSIVE LEANNESS

ORIGINAL

a.



Describe the direction in which the four forces are being applied to the box and also the side of the box on which each one is being applied.

A is being applied from the left of the box to the right

B is being applied from above in an upward direction

C is being applied from the right in a left-hand direction

D is being applied from below in a downward direction

b.

When a sign instructs train passengers to pull the emergency cord, what is it instructing passengers to do?

To apply a downward force to it

c.

What do we mean by the direction of a force? Give two contrasting examples different from the ones used here.

Whether a push or a pull applied to the object is toward the right, left, up, or down

REVISION involves:

The addition of the following problems:

-Before (a):

In which direction is Man B applying a force?

In a right-hand direction

In which direction is Man A applying a force?

In a right-hand direction

From which side of the wagon are Man A and Man B applying the force?

A from the left; B from the right side

What are some of the directions in which a force can be applied to an object?

Up, down, right, left

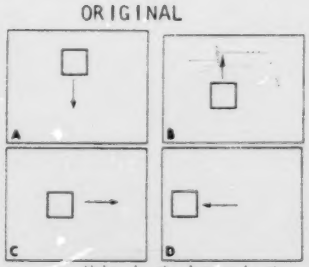
When the sergeant tells recruits to carry their own bags, what kind of force is he telling them to apply to the bags?

A force applied in an upward direction.

#2 INSUFFICIENT LEANNESS

ORIGINAL

a.

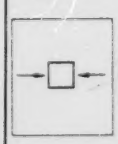


Write in the letter in the appropriate blank indicating the direction of the force.

C to the right *D* to the left

B upward *A* downward

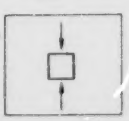
b.



The two forces shown are acting in which two directions?

A right-hand direction and left-hand direction

c.



The two forces shown are acting in which two directions?

In an upward and downward direction

REVISION involves:

The addition of the following problems:

-Following (c):

What are some of the directions in which a force can be applied to an object?

Up, down, right, left

What do we mean by the direction of a force? Give two contrasting examples different from the ones used here.

Whether a push or a pull applied to the object is toward the right, left, up, or down

Due to space limitations and for the purposes of illustrating a point, the examples provided below are artificially exaggerated; in #1 "excessive" is overexaggerated, and in #2 "insufficient" is overexaggerated.

J.2.5

DECISION MATRIX

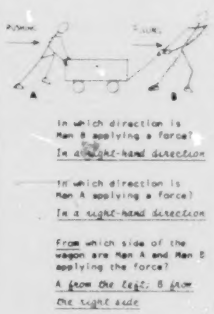
(2) DETERMINING HOW TO REVISE A SERIES OF PROGRAM PROBLEMS TO OVERCOME CONFUSIONS CREATED BY THE SERIES OF PROBLEMS
(On this and on opposite page)

PROGRAM WEAKNESS	Program poorly planned for target audience regarding: ••Vocabulary (low frequency words) ••Sentence length, structure	Omission of or ambiguous statement of: ••Objectives ••Task instructions ••Directions to control attention or observation
ACTION TO TAKE	*-Reduce difficulty level of vocabulary:* *••Replace long words with short words* *••Replace low frequency words with high frequency words (consult word frequency tables)* *-Reduce difficulty level of sentences:* *••Reduce the length of sentences* *••Simplify the grammatical structure of sentences* *••Keep the number of sentences low* *••Eliminate words or devices which are irrelevant to the task at hand*	*-Take care of "omissions" by providing necessary statements or techniques* *-Simplify, clarify, or strengthen all statements or techniques designed to guide:* *••Task performance* *••Attention and observation behavior*

EXAMPLES

e.g.,

ORIGINAL: *Describe the direction in which the four forces (illustrated) are being applied to the box and also the side of the box on which each one is being applied.*


In which direction is Man B applying a force?
In a right-hand direction
In which direction is Man A applying a force?
In a right-hand direction
From which side of the wagon are Man A and Man B applying the force?
A from the left, B from the right side

REVISION: *Four forces are being applied to this box (illustrated). In which direction is each force being applied? To which side of the box is each force being applied?*

REVISION: Add to the original:

Note the directions in which each arrow is pointing.

Also note on which side of the box each arrow is placed.

J.2.5

DECISION MATRIX

(2) DETERMINING HOW TO REVISE A SERIES OF PROGRAM PROBLEMS TO OVERCOME CONFUSIONS CREATED BY THE SERIES OF PROBLEMS
(On this and on opposite page)

	Examples used:	Cues are:
PROGRAM WEAKNESS	••Atypical or low frequency ••In an ineffective sequence or order	••Misleading (calling attention to wrong INPUTS or wrong properties of INPUTS) ••Ambiguous, unclear
ACTION TO TAKE	*-Replace examples less capable of eliciting responses with those more capable of doing so* *OR* *-Reorder the sequence of appearance of those examples:* *••Put concrete examples earlier in sequence before abstract ones* *••Put visual examples before verbal examples*	*-Simplify, clarify, or use new cues to:* *••Call attention to relevant properties of INPUT or ACTIONS* *••Call attention to what are not relevant properties of INPUTS or ACTIONS*

EXAMPLES

(See example on page 198)

e.g.,

ORIGINAL: *Describe the direction in which the four forces (illustrated) are being applied to the box and also the side of the box on which each one is being applied.*

REVISION:

In which direction is Man B applying a force?
In a right-hand direction

In which direction is Man A applying a force?
In a right-hand direction

REVISION: Add to original:

Note that an arrow representing a pulling force and one representing a pushing force are usually applied to different sides of a box.

J.2.5

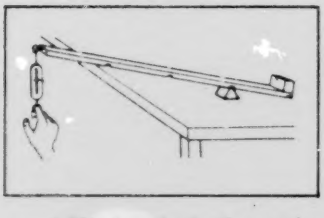
DECISION MATRIX

(3) DETERMINING HOW TO REVISE A SERIES OF PROGRAM PROBLEMS TO OVERCOME THE FAILURE TO PROVIDE APPROPRIATE PRACTICE NEEDED FOR THE ACQUISITION OF SPECIFIC SKILLS
(On this and on opposite pages)

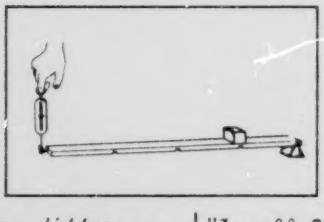
PROGRAM WEAKNESS	DISCRIMINATIONS ••Incompletely treated ••Inadequately treated	GENERALIZATIONS ••Incompletely treated ••Inadequately treated
ACTION TO TAKE	*-Do one or more of the following:* *••Contrast INPUT classes* *••Identify the basis for the difference between classes* *••Identify the boundaries (limits) between classes* *••Provide sufficient cuing to enable discriminations to be made* *••Provide enough examples of differing classes*	*-Do one or more of the following:* *••Show similarities between members of each INPUT class* *••Identify the basis for the similarity between members of each class* *••Identify the limits of each class* *••Provide sufficient cuing to enable generalizations to be made* *••Provide enough or varying examples within each class*

EXAMPLES

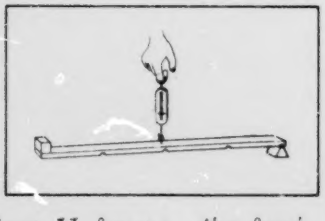
Class I



Class II



Class III



"Note that the primary difference between the classes of levers consists of the position relative to one another of: (1) the load; (2) the effort force; and (3) the fulcrum"

OR

"A diagram containing all three classes (as above) could be provided to give a contrasting overview of the three different classes."

"In all Class II levers, the load is between the effort force and the fulcrum. A wheelbarrow is another example of a Class II lever."

OR

A diagram showing multiple examples can provide an overview of a single class.

J.2.5

DECISION **MATRIX**

(3) DETERMINING HOW TO REVISE A SERIES OF PROGRAM PROBLEMS TO OVERCOME THE FAILURE TO PROVIDE APPROPRIATE PRACTICE NEEDED FOR THE ACQUISITION OF SPECIFIC SKILLS
(On this and on opposite pages)

PROGRAM WEAKNESS	ASSOCIATIONS ••Incompletely treated ••Inadequately treated	CHAINS* ••Incompletely treated ••Inadequately treated
ACTION TO TAKE	*-Do one or more of the following:* *••Identify the basis for associating INPUT class and a given ACTION* *••Provide sufficient cuing to enable associations to be formed* *••Provide sufficient practice problems or examples to enable associations to be formed*	*-Do one or more of the following:* *••Provide sufficient number of opportunities to practice the whole chain* *••Provide cuing to assist the learner to remember the sequence in which parts of the chain are to be performed*

*Failure of students to produce a chain is not inferred; rather, it is directly observed by an observer as the student exhibits procedures or there is an absence of or an error in the "work" (on paper and pencil).

EXAMPLES	Since the designation of a lever class (i.e., I, II, III) is arbitrary (i.e., a matter of convention) and not based on conceptual properties, additional practice in associating labels and examples should be provided.	In chaining verbal statements about definitions of lever classes (in addition to practice involving discriminations, generalizations, and chains) some practice in producing the whole chain should be provided (e.g., stating spatial relationships between load, fulcrum, and effort force).

REVISING THE TOTAL INSTRUCTIONAL PROGRAM

	page
Information sources to review and types of weaknesses which can be identified for a total series of program problems	204
Sources of information about weaknesses of a total program (delayed testing)	205
Identifying the nature of program weaknesses based on results of delayed testing	206
Revising the total program to overcome weaknesses identified by means of delayed testing	207

*

The preceding section on revising a sequential series of program problems is applicable to the "revision of the total program." Accordingly, it will not be repeated.

To be added to the guidelines presented in the preceding section are some considerations about program weaknesses identified (1) by delayed testing, and (2) by the administration of program components in alternative sequences. The first of these follows on the next several pages. The second follows in the next section.

J.2.5
IDENTIFICATION
MATRIX

SOURCES OF INFORMATION ABOUT WEAKNESSES OF A TOTAL PROGRAM

SOURCES	Difference in ERROR data on tests administered BEFORE and IMMEDIATELY AFTER instructional program	Difference in ERROR data on tests administered IMMEDIATELY AFTER the instructional program and on a DELAYED BASIS*
CRITERIA	*From: FORM J.2(2)* *-GROUP error data on all test items related to each sub-criterion behavior and all test items related to the criterion behavior* *From: FORM J.2(3)* *-INDIVIDUAL error patterns on all test items related to each sub-criterion behavior and all items related to the criterion behavior*	
	••The difference in error data obtained before and immediately after program administration serves to identify program weaknesses in allowing student acquisition of: */Sub-criterion and criterion behaviors* */Component skills*	*••The difference in error data obtained immediately after and on a delayed basis after program administration serves to identify program weaknesses in allowing student retention of:* */Sub-criterion and criterion behaviors* */Component skills*

*Delayed testing should be performed during the last tryout cycle when the instructional program is more likely to be capable of producing acceptable "acquisition" levels.

J.2.5
DECISION
MATRIX

IDENTIFYING THE NATURE OF PROGRAM WEAKNESS BASED ON RESULTS OF DELAYED TESTING

	On TOTAL test for: ••Sub-criterion behavior or ••Criterion behavior	On test items related to: ••RECALL/TRANSFER or ••Specific skills
DATA	-IMMEDIATE results show low error rates -DELAYED results show relatively high error rates	-IMMEDIATE results show low error rates -DELAYED results show relatively high error rates
ACTION TO TAKE	*INTERPRET as evidence of:* *-Program failure to provide sufficient practice of the sub-criterion or of the criterion behavior* *-The omission may involve one or more of the following:* *••Absence of sufficient repetition and/or review with old examples* *••Absence of repetition and/or review with new examples*	*INTERPRET as evidence of:* *-Program failure to provide sufficient practice of the component skills* *-The omission may involve one or more of the following:* *••Absence of sufficient repetition and/or review with old examples* *••Absence of repetition and/or review with new examples*

J.2.5
DECISION
MATRIX

DETERMINING HOW TO REVISE A TOTAL PROGRAM EXCESSIVELY LEAN FOR "RETENTION" PURPOSES

PROGRAM WEAKNESS	Insufficient amount of practice of: ••Sub-criterion behavior ••Criterion behavior	Insufficient amount of practice of: ••Component skills ••TRANSFER problems
ACTION TO TAKE	*Do one or more of the following:* *••Add more practice problems at the end of a progression relating to a sub-criterion (or to a criterion) behavior; include:* */Old examples and/or /New examples* *••Following practice with other sub-criterion behaviors, introduce review problems which can include:* */Old examples and/or /New examples*	*Do one or more of the following:* *••Intersperse more practice problems relating to the skills not retained in the middle of the progression which is building up to a sub-criterion or criterion behavior:* */Preferably new examples* *••Insert the problems in that part of the series of problems devoted to a particular skill* *••If two or more component skills were taught separately, consider inserting items dealing with one skill at a time (particularly if retention failure is serious)*

REVISING THE SEQUENCE OF PRACTICE*

	page
Two types of sequencing issues	210
Sources of information about sequencing weaknesses	211
Revising the sequence of practice	212

Review pages 155-158.

J.2.5

IDENTIFICATION **MATRIX**

	TWO TYPES OF SEQUENCING ISSUES	
SEQUENCING ISSUES	Within a SINGLE program devoted to <u>one</u> criterion behavior	Between TWO or MORE programs devoted to two or more criterion behaviors
CRITERIA	-*Have the separate sub-criterion behaviors, all of which relate to a single criterion behavior, been taught in the right sequence; i.e., has the sequence been so arranged that the learning of one sub-criterion behavior facilitated the learning of others; and, in turn, has the learning of the criterion behavior been facilitated by the order in which its constituent sub-criterion behaviors have been learned*	-*Have programs devoted to two or more criterion behaviors been sequenced so that the learning of one has facilitated the learning of one or more of the others*
EXAMPLES	-*The criterion behavior involves the relationship between balanced and unbalanced forces and movement of objects* -*Several sub-criterion behaviors have been identified:* ••*Force* ••*Strength of force* ••*Direction of force* ••*Objects in movement* ••*Objects at rest* ••*Balanced/unbalanced force* -The issue is: Is the order in which each of these sub-criterion behaviors has been learned the optimum one for facilitating the learning of them all?	-*There are several criterion behaviors to be taught which involve these concepts:* ••*Force* ••*Power* ••*Work* ••*Machines* -The issue is: Is the order in which each of these <u>criterion</u> behaviors has been learned the optimum for facilitating the learning of them all?

J.2.5

DECISION MATRIX

WHEN TWO DIFFERENT SOURCES ARE LIKELY TO BE USED		
SOURCES OF INFORMATION	EXPERIMENTAL	STATISTICAL
ACTION TO TAKE	*-Consider using the experimental approach in assessing sequencing adequacy only during INFORMAL tryout:* *••STEP J.1*	*-Consider using the statistical approach both during INFORMAL and DEVELOPMENTAL tryout:* *••STEP J.1* *and* *••STEP J.2*
RATIONALE	-The experimental approach to assessing sequencing adequacy can provide more dependable results on which to base sequencing decisions -It is, however, time-consuming and does dilute the size of the sample -However, when time and student availability permit, it should be considered in both informal and developmental tryouts	

J.2.5
DECISION
MATRIX

DETERMINING HOW TO REVISE PROGRAM IN THE LIGHT OF SEQUENCING DEFICIENCIES*

	Experimental results identify:	Statistical results identify:
RESULTS	-The administered sequence producing: ••Lowest average time to complete separate programs (or program section) ••Lowest average error rate on programs ••Lowest average error rate on tests	-Groups scoring high and low on one program: ••Time to complete two or more programs ••Errors on programs ••Errors on tests -Comparison with these groups on another program reveal whether there is a facilitating effect
ACTION TO TAKE	*-Alter the sequence of practice in keeping with the sequence favored by results*	

*Applicable to sequencing of sub-criterion behaviors related to a single criterion behavior or to sequencing of separate criterion behaviors.

JOB PROCEDURES

	page
Information sources to review and information to look for	214
Priorities to observe in making program revisions	215
SUMMARY OF PROCEDURES	216
Adequacy of the revision process	217

J.2.5
IDENTIFICATION
MATRIX

	INFORMATION SOURCES TO REVIEW AND INFORMATION TO BE OBTAINED		
SOURCES	FORM J.2(2) Errors on programs	FORM J.2(1) Errors on tests (for GROUPS) FORM J.2(3) Patterns of errors for INDIVIDUALS	DIAGNOSTIC test results Results of: ••Interviews ••Observation
CRITERIA	-*Error rate for program which identifies:* ••*Extent of revision needed:* /*Total program* /*Series of program problems* /*Isolated program problems* ••*Specific types of revisions to make:* /*To overcome excessive learness* /*To overcome insufficient learness* /*To overcome confusions* ••*Sequencing failures*	-*Error rate on tests identifies:* ••*Acquisition and retention difficulties* /*Sub-criterion and criterion behavior* /*Component skills* ••*Types of errors:* /*Omissions* /*Systematic wrong answers* /*Variable wrong answers*	-*Error rates on tests or results of interviews or of observation identify:* ••*Specific skills not learned* ••*Features of program which contribute to difficulty:* /*Vocabulary, sentence structure* /*Instructions about tasks or what to observe*

J.2.5
DECISION
MATRIX

PRIORITIES TO OBSERVE WHEN LARGE SCALE REVISION IS TO BE MADE (I.E., IN TOTAL PROGRAM)

PRIORITIES	1st priority occurring in the FIRST revision cycle	2nd priority occurring in the SECOND revision cycle	3rd priority occurring in the THIRD revision cycle
ACTION TO TAKE	-*Keep "the AMOUNT of criterion behavior practiced at the same time" unchanged* -*Consider one or more of the following approaches:* ••*Strengthen the degree of assistance to the program problems already in the sequence and/or remove assistance less early in the sequence* *OR* ••*Introduce new program problems to the sequence providing more examples (new or repetitions)*	IF THE SECOND TRYOUT STILL PRODUCES ERRORS ON A SERIES OF PROGRAM PROBLEMS: -*Keep "the AMOUNT of criterion behavior practiced at the same time" unchanged* -*Definitely add new program problems appropriate to the skills with which students have difficulties (Intersperse the new problems among the existing problems)* -*Also consider strengthening the degree of assistance for existing problems*	IF THE THIRD TRYOUT STILL PRODUCES ERRORS ON A SERIES OF PROGRAM PROBLEMS: -*Reduce the amount of criterion behavior practiced at the same time (one level lower on each successive revision)* -*Also consider adding new program problems*

EXAMPLES	SEE SECTION "I," PAGES 73-96, FOR EXAMPLES OF PROGRAM SEQUENCES DIFFERING IN "AMOUNT" OF CRITERION BEHAVIOR PRACTICED AT THE SAME TIME

J.2.5

ILLUSTRATION SUMMARIZING PROCEDURES INVOLVED IN REVISING INSTRUCTIONAL PROGRAM

#1

REVIEW

a. Error data for program: FORM J.2(2)

b. GROUP error data on tests: FORM J.2(1)

c. INDIVIDUAL error patterns on tests: FORM J.2(3)

d. Diagnostic test results

e. Interview and observational results

#2

IDENTIFY

a. Extent of program weakness

b. Nature of program weakness regarding:

- ••Sub-criterion and criterion behaviors
- ••Component skills
- ••TRANSFER requirements
- ••Retention requirements
- ••Sequencing

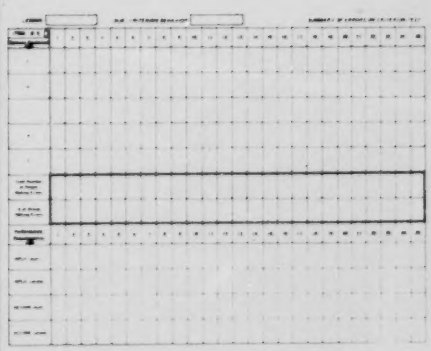
#3

REVISE

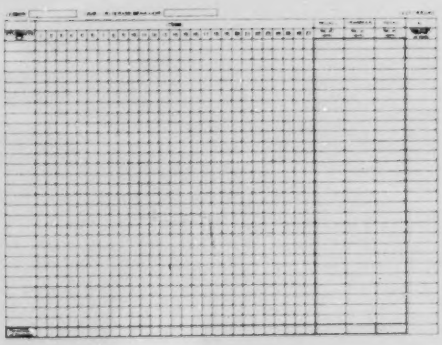
a. Program to overcome identified weakness

b. Program observing priorities for keeping program as lean as possible consistent with acceptable achievement levels

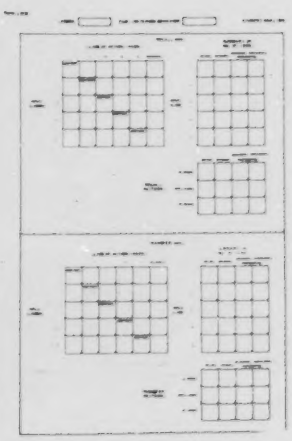
FORM J.2(1)



FORM J.2(2)



FORM J.2(3)



J.2.5

STANDARDS MATRIX

ADEQUACY OF PROGRAM REVISION

PROPERTIES	DATA-BASED	COMPLETENESS	MAGNITUDE
CRITERIA	-*To the extent possible, specific program weaknesses are identified by direct evidence and by inference from data:* ••*Student performance on the instructional program itself* ••*Student performance on criterion tests and on diagnostic tests* ••*Results of interviews and observation*	-*Revisions in program are addressed to failures in all three:* ••*Acquisition* ••*Retention* ••*Transfer (to new examples)* -*Weaknesses removed involve:* ••*Content (amount and type of practice, etc.)* ••*Format (vocabulary, etc.)* ••*Behavior control features (Instructions, etc.)*	-*Revisions made adhere to priorities in amount of change required:* ••*Individual program problems* ••*Series of problems* ••*Total program* *(No more change is made than is required)* -*Revisions make no changes in the amount practiced (at the same time" except when later stages of tryout reveal them to be necessary*

STEP J.2

COMPLETION CHECKLIST

	IDENTIFIED	PERFORMED	PRODUCED	FORMS COMPLETED
J.2.1	Entering proficiency of developmental tryout sample	Administration of a "before" test		FORM J.2(1)
J.2.2	Errors on program	Administration of instructional program		FORM J.2(1)
J.2.3	Errors on tests	Administration of "after" tests		FORM J.2(1) FORM J.2(2) FORM J.2(3)
J.2.4	Types of learning failures	Diagnostic tests and interviews		
J.2.5	Program weakness		Revised program	

STEP J.3

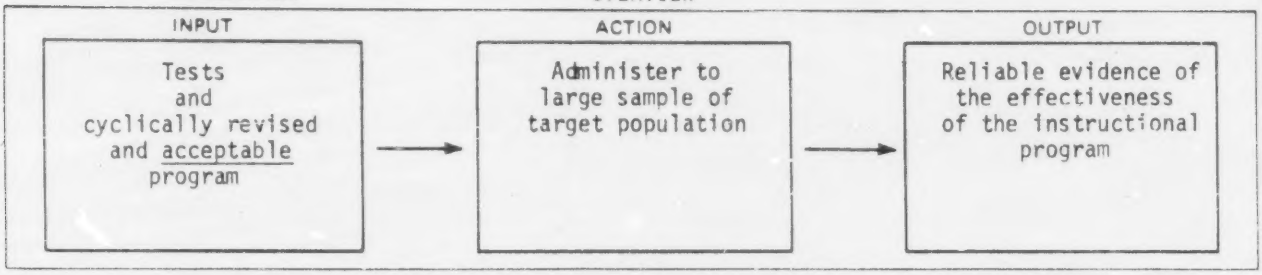
J.3 Conduct a field test of the instructional program.

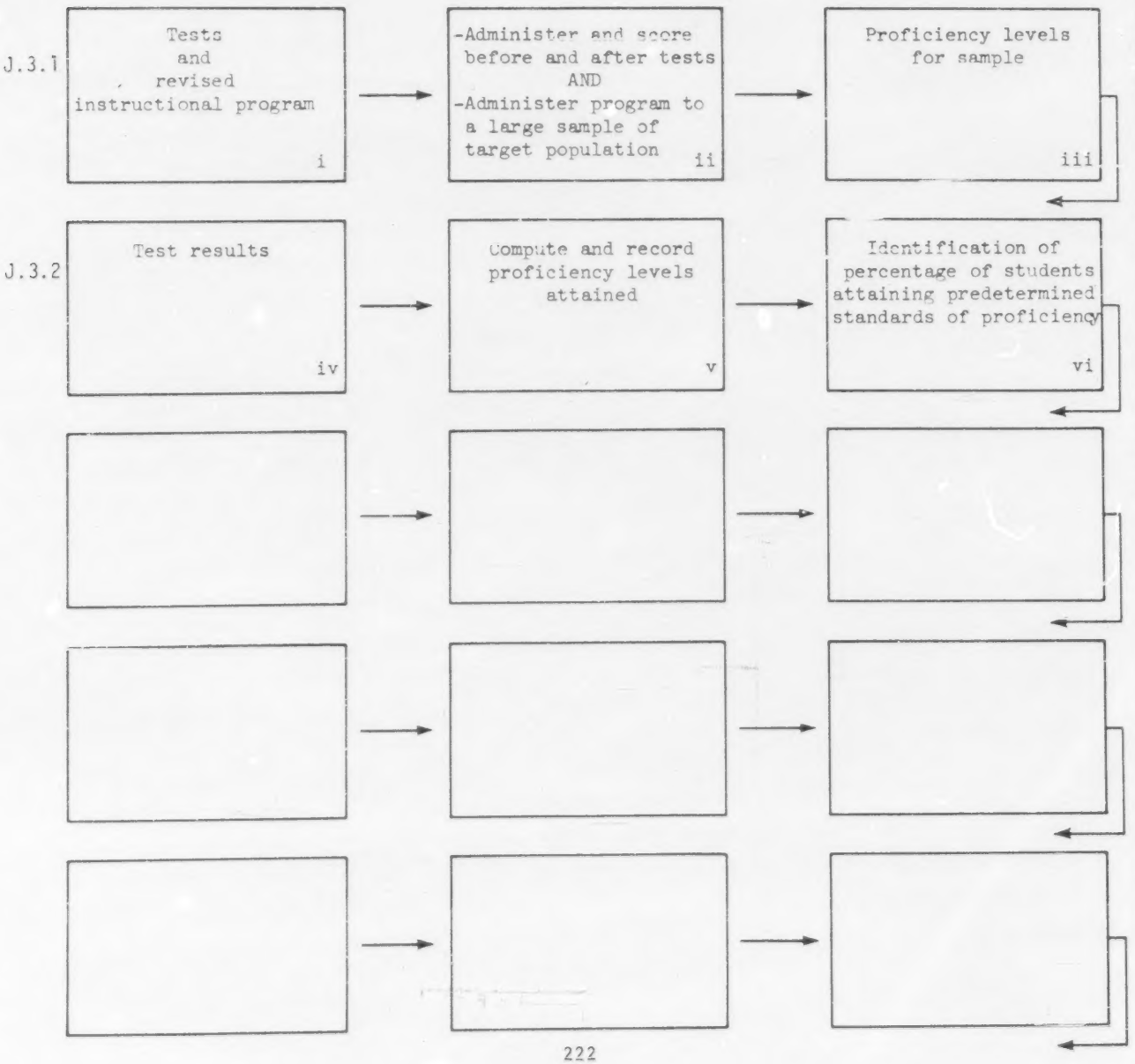
J.3.1 Administer pre- and post-tests and the instructional program to a large sample of the target population.

J.3.2 Report results of the field test.

STEP J.3

OVERVIEW


INPUT
ACTION
OUTPUT
Tests and cyclically revised and acceptable program
Administer to large sample of target population
Reliable evidence of the effectiveness of the instructional program



STEP J.3

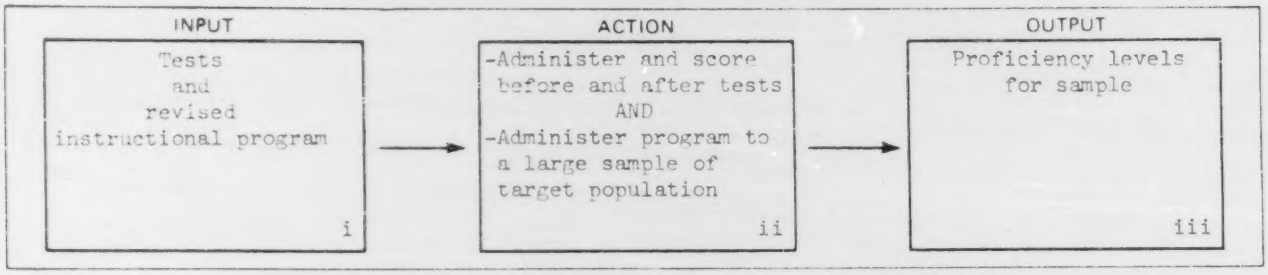
PAGE INDEX

	CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
.1			-MATRIX: Adequacy of field test administration .229	FORM J.2(2) SUMMARY OF PROCEDURES . . . 228
.2			-MATRIX: Adequacy of report of results 235	SUMMARY OF PROCEDURES . . . 234

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*An identification of the proficiency level attained by a large sample of the target audience (n of approximately 100-200 students).*
WHAT YOU WILL WORK FROM	1) Sample of target audience (2) Revised program (3) Tests
WHAT YOU WILL DO	(1) Administer tests BEFORE and AFTER program administration (2) Administer program to sample of target audience (3) Score tests and identify proficiency levels attained
FORMS YOU WILL USE	FORM J.2(2) for recording test results.

DESCRIPTION OF Sub-STEP	J.3.1



Job Aid Contents

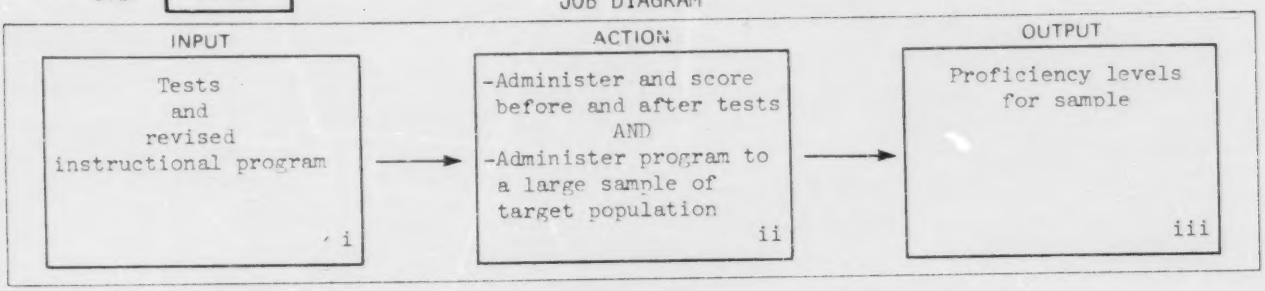
CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
		-MATRIX: Adequacy of field test administration .229	FORM J.2(2) SUMMARY OF PROCEDURES . . . 228

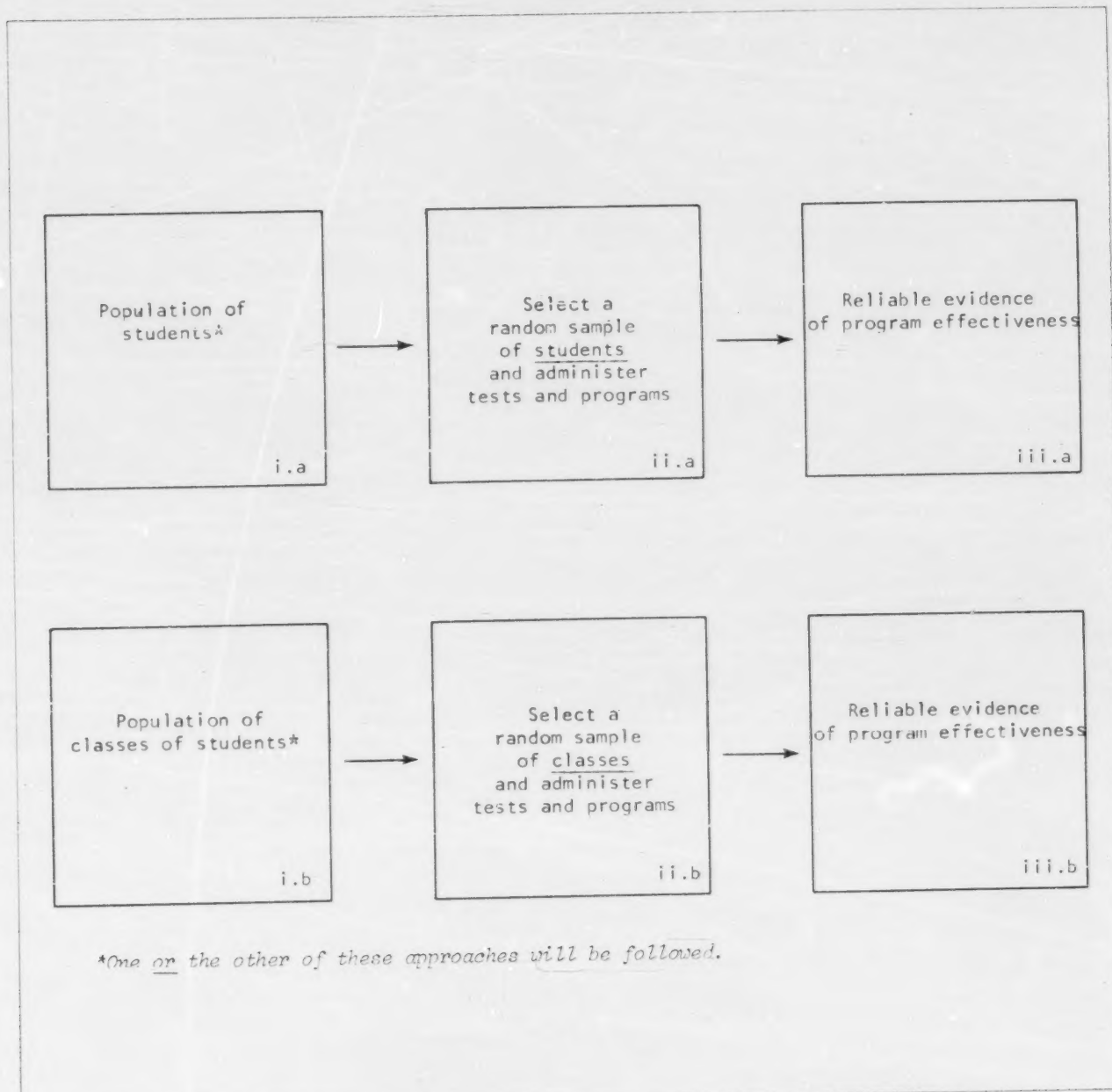
Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
Final revised program plus tests	J.2.5			FORM J.2(2)

Sub-STEP J.3.1

JOB DIAGRAM





*One or the other of these approaches will be followed.

JOB PROCEDURES

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SUMMARY OF PROCEDURES	228
Adequacy of the administration of the field test	229

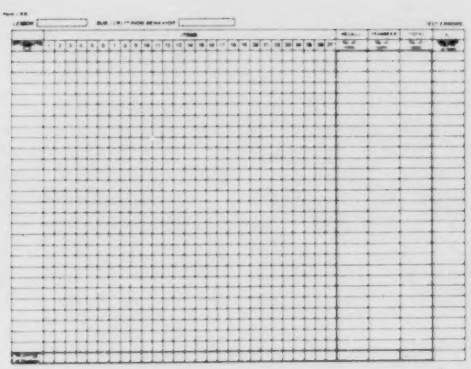
J.3.1

ILLUSTRATION SUMMARIZING PROCEDURES INVOLVED IN ADMINISTERING A FIELD TEST OF THE INSTRUCTIONAL PROGRAM*

#1	#2	#3
a. Select a sample of students which is representative of the target audience b. Whenever possible, select individual students on a random basis c. If necessary to use intact classes of students, select classes on a random basis (a minimum of about 15 classes) d. Insure that the sample includes a minimum of approximately 100 students. Sample sizes which are larger (up to approximately 300 students) will yield more reliable results	a. Administer criterion and sub-criterion tests as "before" tests b. Administer instructional program c. Administer tests once again as an "after" test d. Score tests for errors	a. Record test results on FORM J.2(2)

**Field results are likely to involve programs for more than one criterion behavior. They are likely to include programs for an entire course.*

FORM J.2(2)



J.3.1

STANDARDS MATRIX

ADEQUACY OF ADMINISTRATION OF FIELD TEST

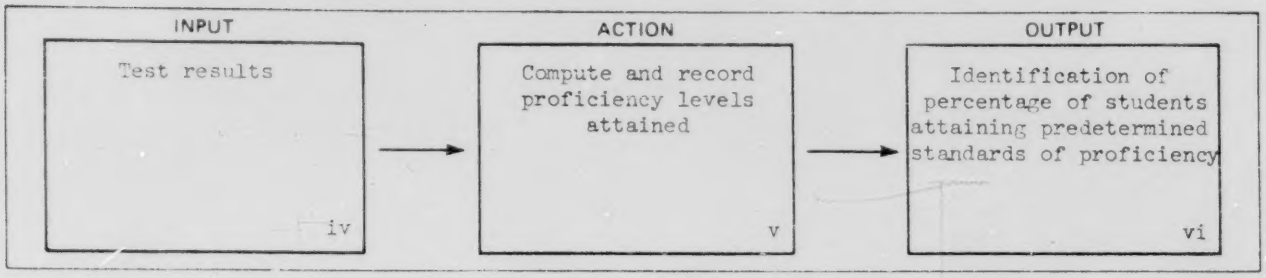
PROPERTIES	SAMPLING ADEQUACY	COMPLETENESS
CRITERIA	-*Sample is randomly selected from target audience:* ••*Randomly by individual students* ••*Randomly by classes of students* -*Sample size:* ••*Minimum of 100 students* ••*Maximum of approximately 300 students**	-*Tests are administered:* ••*Before and after the administration of the program* -*The program is administered to all (or nearly all) the sample, and all students are given adequate opportunity to complete the program*

*The more widespread the anticipated use of the program, the more desirable it is to have a large sample size for field testing the program.

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*An identification of percentage of students attaining predetermined levels of proficiency (e.g., 90% correct).*
WHAT YOU WILL WORK FROM	(1) Test results
WHAT YOU WILL DO	(1) Compute percentage of students achieving each criterion behavior (2) Compute percentage of criterion behaviors achieved
FORMS YOU WILL USE	None

DESCRIPTION OF Sub-STEP	J.3.2



Job Aid Contents

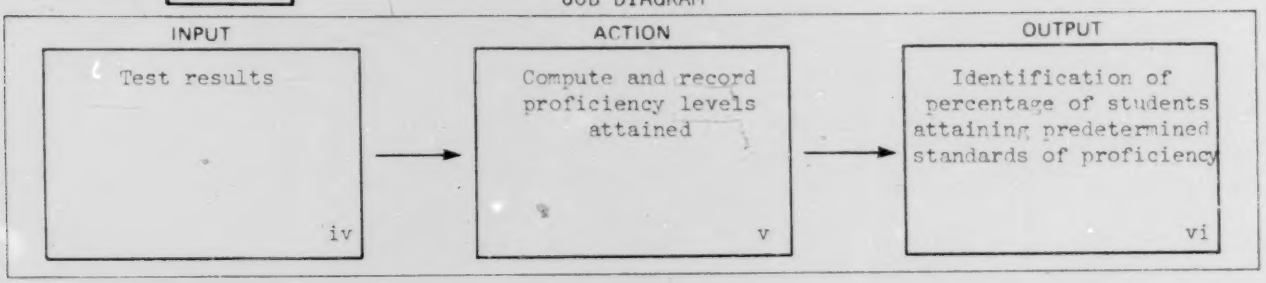
CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
		-MATRIX: Adequacy of report of results 235	SUMMARY OF PROCEDURES . . 234

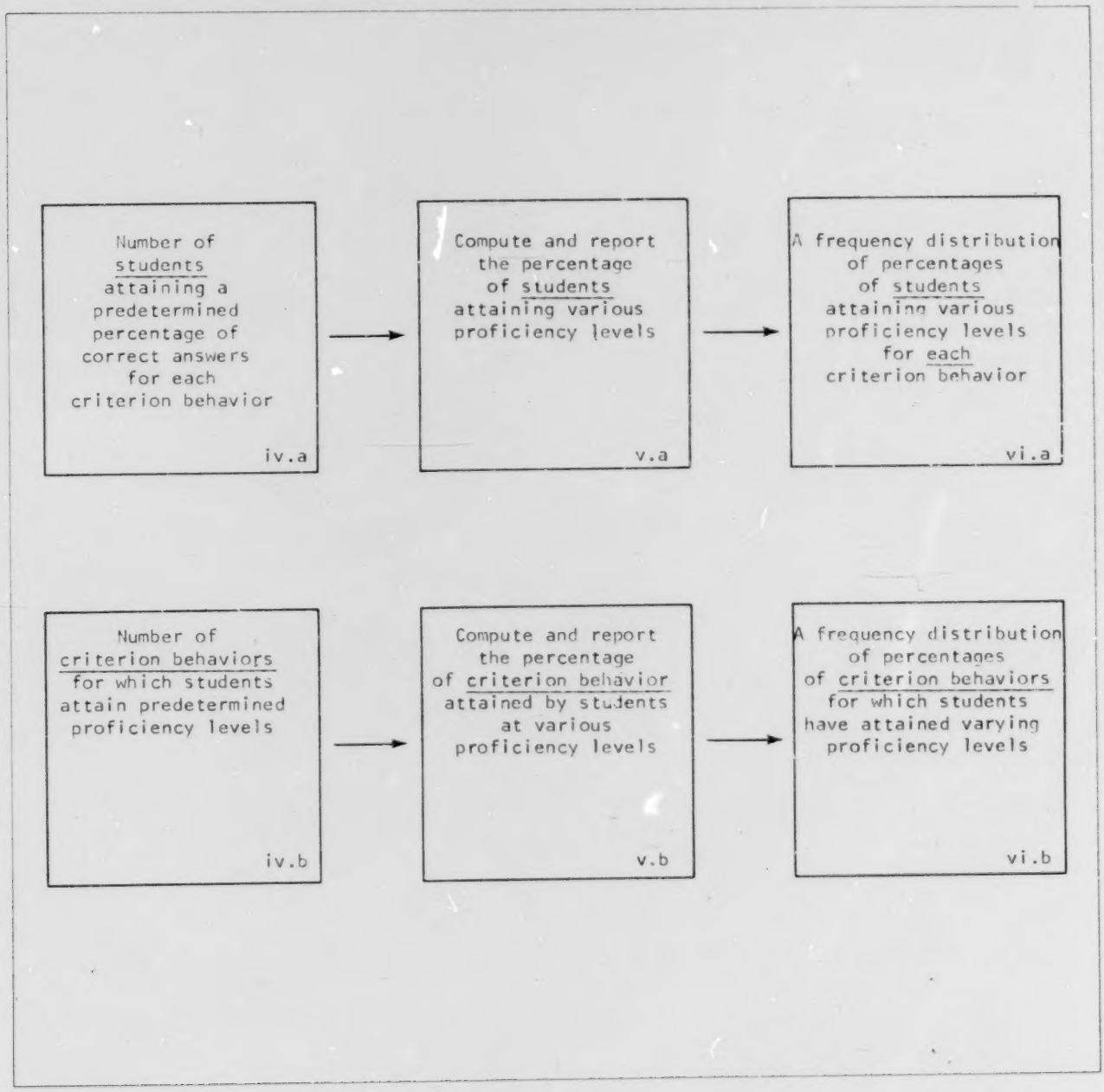
Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
		FORM J.2.2: Before and after test results	J.3.1	

Sub-STEP J.3.2

JOB DIAGRAM




Number of students attaining a predetermined percentage of correct answers for each criterion behavior
iv.a
Compute and report the percentage of students attaining various proficiency levels
v.a
A frequency distribution of percentages of students attaining various proficiency levels for each criterion behavior
vi.a
Number of criterion behaviors for which students attain predetermined proficiency levels
iv.b
Compute and report the percentage of criterion behavior attained by students at various proficiency levels
v.b
A frequency distribution of percentages of criterion behaviors for which students have attained varying proficiency levels
vi.b

JOB PROCEDURES

	page
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Adequacy of report of field test	235

J.3.2

ILLUSTRATION SUMMARIZING PROCEDURES INVOLVED IN REPORTING FIELD TEST RESULTS

#1

From FORM J.2(2) summarizing test results for:

- ··Each sub-criterion behavior related to each criterion behavior

AND

- ··Criterion behavior

a. Compute for each student either:

- ··The percentage of items answered correctly

OR

- ··The percentage of items answered incorrectly

b. Correct the number of students attaining proficiency (or errors if preferred) in various score intervals:

- ··90% or above
- ··80%-89%
- ··70%-79%

c. Express the number of students attaining these levels as a percentage of the total sample

d. Do this for "before" and "after" tests

#2

a. Report the number of sub-criterion behaviors associated with each criterion behavior meeting various standards:

- ··Percentage of sub-criterion behaviors for which (for example) 90% of students attain 90% of the test items

b. Report other lesser standards met:

- ··e.g., percentage of criterion behaviors for which 80% of students attain 80% of test items

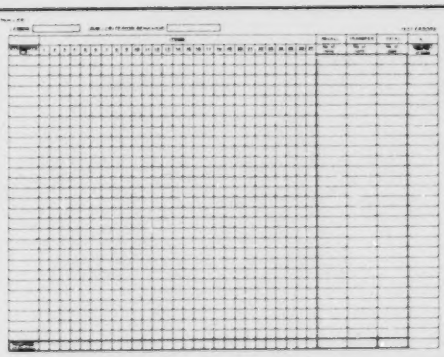
c. Present a frequency distribution of standards met for all criterion behaviors covered by an entire program

#3

a. Describe the sample of students used in the field test:

- ··Size of sample used
- ··Characteristics of sample:
  - /Age
  - /General ability levels
  - /Other information which is available and thought to be relevant to criterion behaviors to be learned

FORM J.2(2)



J.3.3

STANDARDS **MATRIX**

ADEQUACY OF REPORT OF FIELD TEST RESULTS

PROPERTIES	COMPLETENESS of report of RESULTS	COMPLETENESS of SAMPLE description
CRITERIA	-A report summarizing the percentage of students attaining various proficiency levels for: ••Each sub-criterion behavior related to a criterion behavior ••Each of the criterion behaviors ••All of the criterion behaviors covered by a complete program -A report summarizing the percentage of sub-criterion and criterion behaviors attained at varying levels of proficiency -A report summarizing the difference between results obtained "before" and "after" program administration	-A description of the field test sample: ••Number of students ••How selected ••Age, IQ ••Other pertinent information available
EXAMPLE	-Criterion Behavior #1 - 93% of sample scored 90% or better 05% of sample scored 90% or better Etc. -Criterion Behavior #2 - 90% of sample scored 90% or better 08% of sample scored 80% or better Etc. -Criterion Behavior #3 - Of the 32 criterion behaviors taught, 80% were taught at a 90%/90% level (See above), 15% were taught at a 80%/80% level, etc.	-Sample size: 200 -Grade level: 3 -Age: Average = 8.2 -IQ: Average = 101

STEP J.3

COMPLETION CHECKLIST

	IDENTIFIED	PERFORMED	PRODUCED	FORMS COMPLETED
J.3.1		Administration of tests and program Scoring of tests		
J.3.2			A report of proficiency levels	